ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

JANUARY 1961

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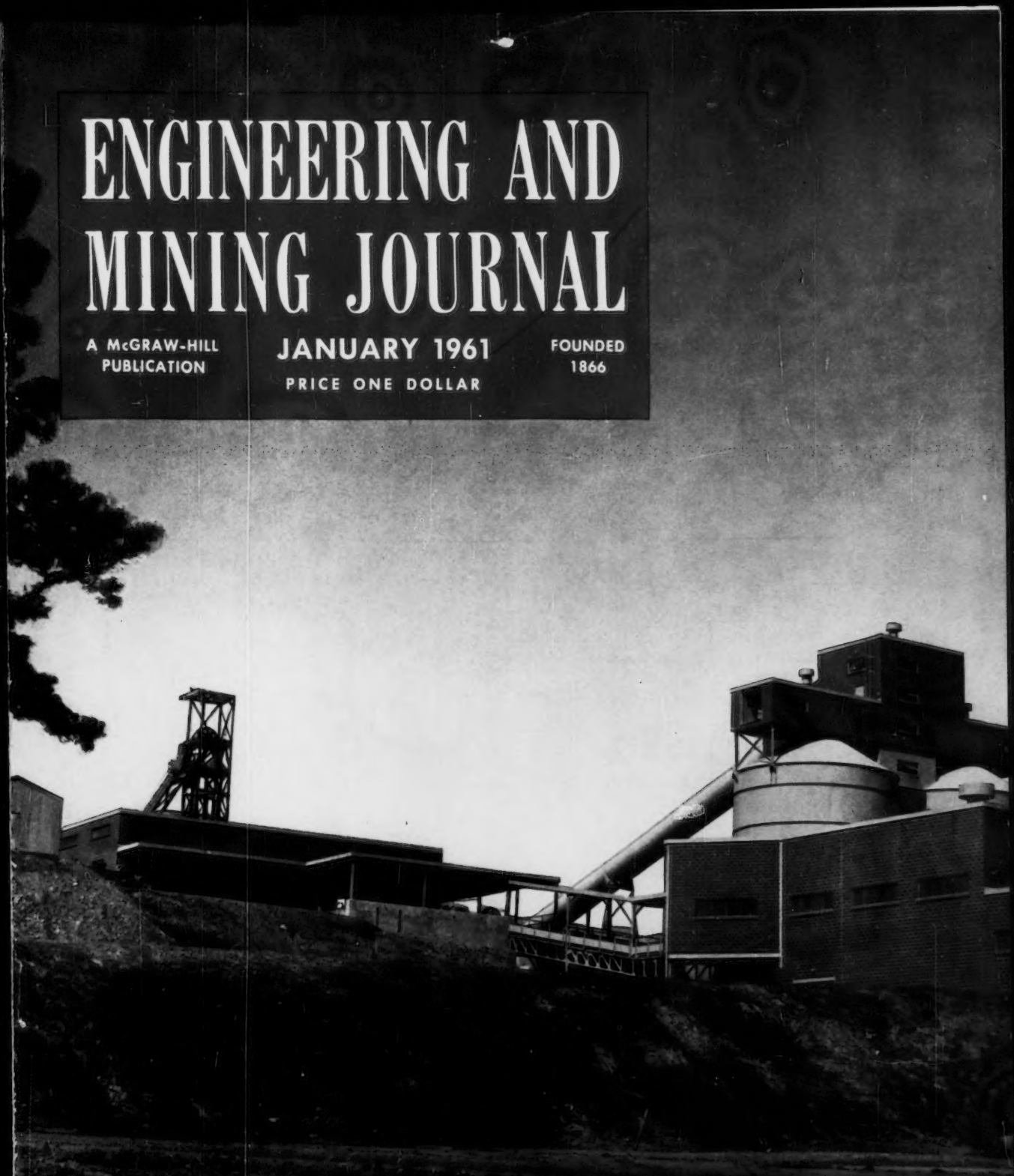
FOUNDED 1866



Viburnum Starts Production

E&MJ's Annual Census of New Mines and Plants...79

Review of Mining Practice . . . . 88; Processing 96

The A-S-H equation for pumping abrasives / corrosives

ENGINEERING LORE
based on keeping performance records of nearly every A-S-H pump sold.

+

FLEXIBLE DESIGN
Split-shell interchangeable rubber-lined pumps, for instance.

+

EXPERIENCE in APPLYING METALS and ELASTOMERS
to meet tough pumping conditions.

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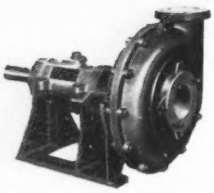
Greater PUMPING EFFICIENCY

+

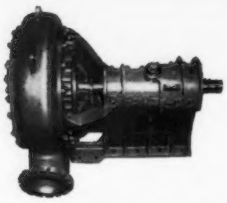
Lower OPERATING COSTS



Hydroseal & Centriseal split-shell interchangeable rubber-lined pumps are slurry and sand types.

Have we a secret that can be turned to good use for you? No one will ever know unless you tell us about your pumping problem. If it is in mining or in processing—metallurgical or chemical, write us.

THE ALLEN-SHERMAN-HOFF PUMP CO.
Dept. B—P.O. Box 635, Paoli, Pa.
Representatives throughout the World



Hydroseal all-metal sand and dredge pump for abrasives over ¼" diameter.

HYDROSEAL and CENTRISEAL
SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

From Secondary Fragmentation to Machinery Erection . . .

P&H Truck Cranes Outproduce on 101 Utility Jobs

A great variety of day-to-day tasks in open pit mining operations are handled by versatile P&H Truck Cranes.

Take this drop ball application, for example: The husky four-axle P&H 40-ton 565A-TC is uniquely qualified with its widespread ground bearing points combined with pneumatic tires to shrug off impact created by release of the ball. It is equipped with fast, MAGNETORQUE® swing, the electro-magnetic clutch with no friction elements—to protect against the stresses of swinging the ball laterally.

Result? Higher production—less maintenance, whether the rig is rehandling aggregate, charging storage bins or used for secondary fragmentation.

Fast rubber tire mobility is designed for moving between production and maintenance jobs . . . quick on-the-job changeover to any front end attachment is another reason why P&H truck cranes perform so many utility jobs.

Other work advantages include:

- **Longer wear and heavier duty with extra rugged planetary gear drive rear axles.**
- **Lower maintenance with P&H power box design —all parts running in oil.**
- **Positive control with self-adjusting P&H power hydraulic system.**
- **"Triple-safe" independent boom hoist with automatic brake and planetary lowering—so important for precise positioning.**
- **Rugged 8 x 4 carrier built by P&H matched to work perfectly with P&H upper.**

For complete information, see your P&H distributor or write for Bulletin TX266.

HARNISCHFEGER
Milwaukee 46, Wisconsin

P&H CONSTRUCTION & MINING DIVISION

P&H LINE: Electric Excavators: 3½ through 10 yards • Diesel Excavators: ½ through 4½ yards • Truck Cranes: 10 through 90 tons

Outside of the United States, P&H equipment is manufactured in Australia, Brazil, Canada, Germany and Japan.

Mining Calendar

Light Metal Industry Symposium, National Metallurgical Laboratory, Jamshedpur, India, February 1961

International Symposium on Mining Research, University of Missouri, Rolla, Mo., Feb. 21-25 1961

AIME annual meeting, Chase-Park Plaza and Ambassador Hotels, St. Louis, Feb. 26-March 2 1961

Western Mineral Congress, Ambassador Hotel, Los Angeles, March 20-24 1961

Fourth Symposium on Rock Mechanics, Pennsylvania State University, University Park, Pa., March 30-April 1 1961

International Symposium on Agglomeration, Philadelphia, April 12-14 1961

Wyoming Mining Association Convention, Rawlins, Wyo., April 21-22 1961

AIME-Southwest Mineral Industry Conference, Stardust Hotel, Las Vegas, Nev., April 24-25 1961

High Temperature Materials Conference, Cleveland Section, AIME, Hotel Pick-Carter, Cleveland, April 26-27 1961

Sixth Annual Uranium Symposium, Grants, N.M., May 12-14 1961

Commemoration of the 50th Anniversary of Froth Flotation in the U.S., sponsored by MBD of SME, Cosmopolitan Hotel, Denver, Sept. 17-20 1961

Northwest Mining Association Convention, Davenport Hotel, Spokane, Wash., Dec. 2-3 1961

Coming Up

Next month—The 92nd Annual Survey & Outlook issue. Some 45 commodities will appear, along with our two-color chart of the year's prices of major metals.

Authors from industry, the Bureau of Mines and the E&MJ staff will present complete views of the respective commodities, along with some estimates of future markets and production.

E&MJ has just returned from Antarctica where we've been getting a look at Operation Deep Freeze 61's probings into geology, geophysics, auroral physics, and the oceanographic disciplines.

What impressed us most about the National Science Foundation-U.S. Navy program was how, with the latest transportation and detecting devices and methods, they're minimizing the effects of Antarctica's extreme environment.

In issues to come, we will show what's being done, how the scientists are tackling their projects, and what immediate and long-range results may come out of all the present and planned research.

94th YEAR OF PUBLICATION

ENGINEERING AND MINING JOURNAL

JANUARY 1961 A McGRAW-HILL PUBLICATION *Volume 162, No. 1*

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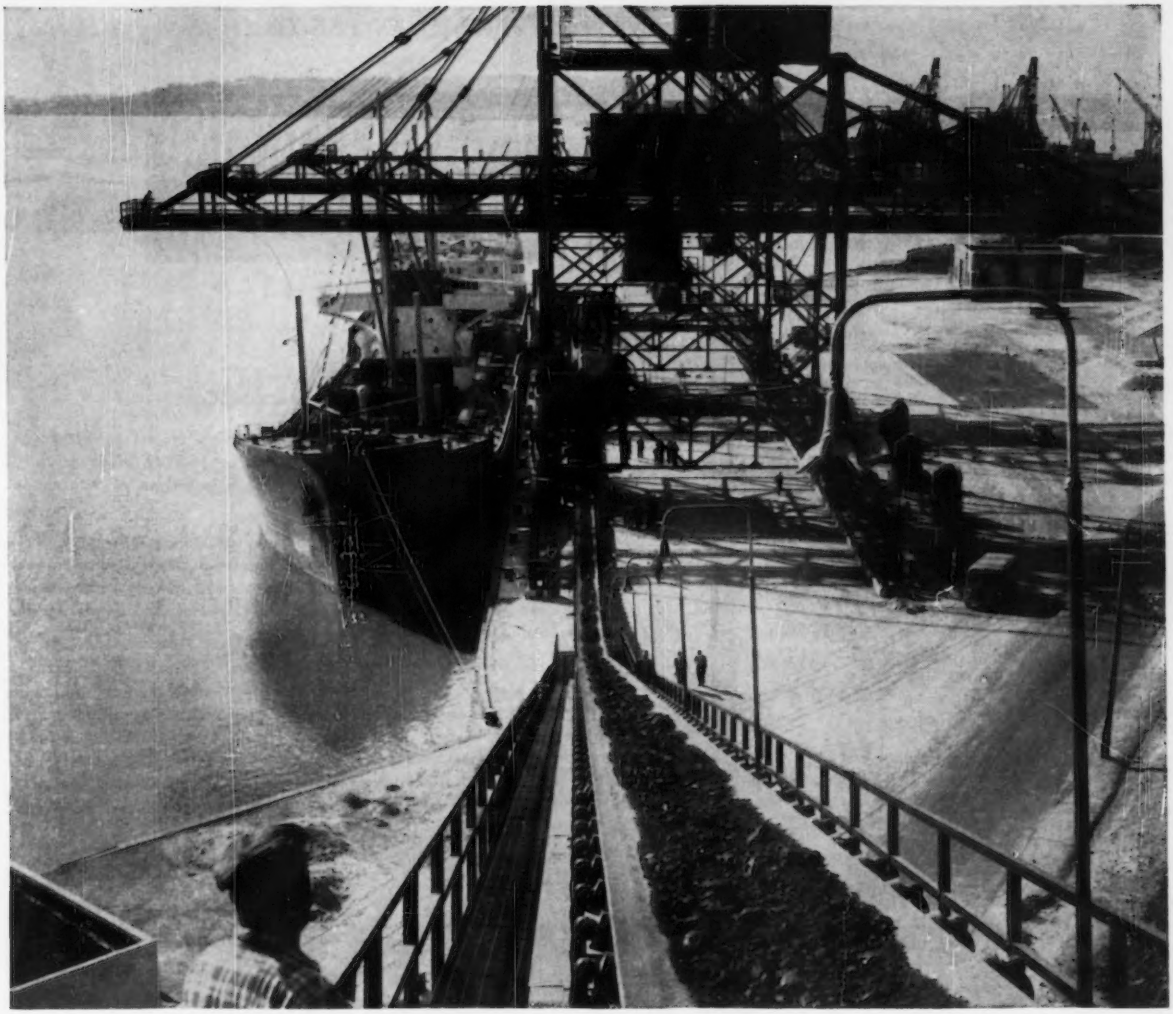

Belt gets up and goes— unloads ore ships in a hurry

After 9 million tons, B.F.Goodrich belt still going strong

At this pier, iron ore is unloaded from ocean-going freighters at a 2000-ton-an-hour clip. The conveyor belt rushes it up to waiting railroad cars. The whole system works so well that even the largest ore-carrying vessels can be emptied in less than 24 hours.

To stand the heavy loads, the speed, and to insure continuous operations, the engineers in charge selected a B.F.Goodrich conveyor belt. Special chemicals, developed by BFG, were added to the rubber to keep the belt "live" and elastic, help it resist the effects of air, sun, weather. Patented layers called "breakers" were built into the belt to increase impact resistance.

The trouble-free performance of the B.F.Goodrich belt has helped make this B & O Pier, Curtis Bay, Maryland, one of the biggest, fastest and most efficient ore-handling facilities on the East Coast. And after carrying nine million tons, the BFG belt is still in good condition.

But good as this record is, chances are that it will soon be bettered because of the improvements that are constantly being made in B.F.Goodrich belts. In recent years, for example, the use of improved rubber compounds and stronger fabrics has resulted in belts that can carry heavier loads farther and faster than ever before, and last longer doing it.

B.F.Goodrich distributors have full information on the belt described here. And, as factory-trained specialists in rubber products, they can answer your questions about the many rubber products BFG makes for industry. *B.F.Goodrich Industrial Products Co., Dept. M-951, Akron 18, Ohio.*

B.F.Goodrich

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Articles in this issue of

ENGINEERING AND MINING JOURNAL

Continued from p 2

65 St. Joe's Viburnum Project Starts Production

Southeastern Missouri's newest mining and milling project is introduced in this issue in full detail (thanks to the kind cooperation of Elmer Jones and his staff) because it incorporates the major items of interest to today's miner and mill man.

St. Joe's lead-zinc properties in Missouri have been a proving ground where many years of continuous production from basically similar mineral deposits have enabled the mine operators to revise and improve their methods. The story is a fine example of the coordination of plant design, methods and equipment to achieve high efficiency.

With the discovery of the three orebodies that comprise the Viburnum project, the staff started on a clean field, free to use the very best and latest in design, tools and techniques that had evolved in the company's long history in the area. As an added attraction, we have included those examples of company management philosophy which also go into the making of a great mining project: the new and challenging areas of community relations, automatic controls, product and process flow, and basic design.

88 Mining Practice—Better Techniques from Better Equipment

Progress in mining techniques in recent years has been closely associated with new equipment design, with major emphasis on some of the bigger production units. Aluminum, alloy plate and high-strength steel are becoming increasingly important material for mining machines.

New developments in the pit include the electric wheel, the inclined rotary drill, the "metallized-explosive" and the use of detergents in drilling. Increased emphasis is being placed on bucket-wheel excavators, skips, conveyors and dredges. Underground, the raise-climber has proved successful and trends are to the cylinder cuts, small diameter holes, diesel power, remote-controlled jumbos, slushers and loaders, automatic friction hoists and the versatile conveyor. A new development in rock breaking and haulage—the electro-hydraulic breaker and hydraulic pipeline-pump—may open the door to a new concept in mining.

96 Processing 1960—More Instrumentation and Control

Mineral processing goes along with other industries as plants introduce more and more exact instruments, controls and automatic devices. New processes in iron ore, aluminum, copper and others made headlines during the year, including some intriguing implications of direct reduction of Al and Cu as well as Fe. "Untreatable" minerals, like copper silicates and semi-taconites, are now coming under attack.

79 Starting the New Decade—A Census of New Mines and Plants

E&MJ's annual census of new mines and plants, a regular feature of the Annual Survey & Outlook Issue, has been moved up to the January issue to better give you an idea of where we are, and where we're going. Once again, we have added representative illustrations to show that while the mining industry may not be beginning the best year of its history, there's enough invention, vitality and growth coming up to keep us all excited.

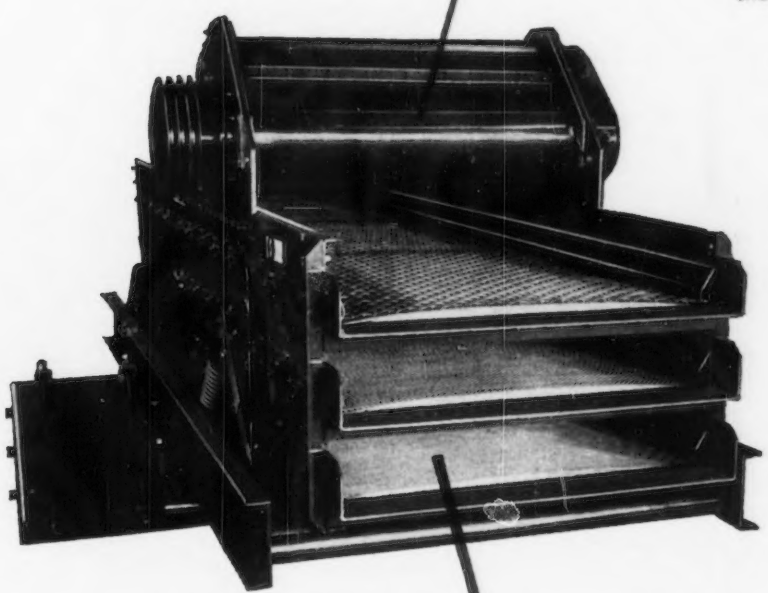
NEW SIMPLICITY HORIZONTAL VIBRATING SCREEN

• CONVEYS AND SCREENS material in mining and gravel plants where minimum headroom is a problem

Simplicity Engineering Company has built a new horizontal vibrating screen, Model OA-95, designed to operate in mining and crushed stone plants where headroom is the governing factor. In this type of operation, it is necessary to both convey the oversize material and screen the undersize material. To do these two jobs successfully, the rugged shaft assemblies have two full length, cast alloy off-set shafts. These counter-rotating shafts, geared together, with heavy duty precision bearings that run in oil, provide the extra power needed to operate large screen areas on an efficient basis.

The Model OA-95 is equipped with a straight line deck designed to withstand the punishment of severe impact and loading stresses. The one-piece deck has all-welded construction and is stress relieved in an electric furnace to insure greatest strength and durability.

Available in sizes from 4′ x 10′ to 4′ x 16′, the new, 3-deck screen can be quickly converted to a two-deck unit by removing the center deck.



For complete information on the OA-95 Horizontal Vibrating Gravel Screen and other screening equipment, scalpers, feeders and feeder grizzlies manufactured for the gravel and mining industries, write to Simplicity Engineering Company.

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94 YEARS OF MINING

The following news items are reprinted substantially as they first appeared in the AMERICAN JOURNAL OF MINING, the publication which became *E&MJ*.

LOWER CALIFORNIA, APRIL 1866—The sale of the Triunfo mine and mills to eastern capitalists is an important and fortunate event for this Territory. The company's liabilities here amount to $50,000. Henceforth our money-lenders will hardly be able to obtain four and five per cent monthly interest, as they have for the past two years.

INDIANA, APRIL 1866—The INDIANAPOLIS JOURNAL says: "We have seen and examined some gold from Brown County, and it is as near the pure metal, and is found in as large quantities, as it is in California. Old miners say that the mines in Brown County will pay equally as well, if not better, than the mines of the golden El Dorado."

NEW MEXICO, MAY 1866—Gold has been found near Santa Fe, and in Rio Arriba County a silver mine has been found which was once worked by the Mexicans.

ARIZONA, MAY 1866—Letters from La Paz say that immense veins, containing many thousand tons of copper ore, have been opened in the Great Central and Mineral Hill mines at William's Fort, and a strong mining excitement has sprung up.

IDAHO, MAY 1866—The Owyhee AVALANCHE says the existence of diamonds in the district is now as fully established as that of gold and silver; and that those found by Wilson were not picked up on the surface, but in a deep prospect hole sunk for gold.

MICHIGAN, MAY 1866—From the Keweenaw TIMES: The Aetna stamp mill is running again, and, we learn, producing very well. The engine has been fitted up in good style, and is doing its work well . . . The St. Clair is running four heads of stamps, by means of an overshot wheel, which is located on the east branch of Eagle river.

This month in

ENGINEERING AND MINING JOURNAL

Continued from p4

Behind the By-Lines

Our old friend, the beachcomber, in one of his more cheerful moments, has notified us of the epitaph he prefers to have carved above his final resting place: "Every time the world zigged—I zagged." We are asking his permission to use the phrase even before the time of our own departure; possibly even having it tattooed on our meagre chest.

What got us into this doleful mood was the realization that in last month's issue, on p 145, we made one of the greatest goofs in our goof-ridden existence.

Our stalwart correspondent, Signor Gene di Raimondo, filed a story from Milan concerning Montecatini's new kainite mine and the potash which would be produced from the property. By the time you saw it, (and if you saw it, we'd just as soon you didn't mention it to anyone else) we had the busy Montecatinians extracting potash from kyanite! As the thoughtful Dr. Thos. Hendrickson of Golden, Colo., observed, "They'll have a Merry Christmas doing it!" Sincerest apologies to the Messrs. Montecatini, di Raimondo, Hendrickson, Paul Bennett, Robert Greenwood and James D. and Edward S. Dana.

We have found three sources of mild consolation for mining men in these, our troublous times. While none is earth-shaking, each has separately and collectively helped to cheer us. Item number one appeared in a press release considering the publication of a new magazine called BEACHCOMBER, and article by one Harold J. Grossman, beverage consultant to the American Hotels Assn.

The men of the mining industry, according to Mr. Grossman, are credited with the development of the Daiquiri cocktail. That noteworthy event took place after the Spanish-American War, when a group of Yanquis were working at the Daiquiri Mines, located between San Juan Hill and Santiago. "The job was hard, the climate hot," says Mr. Grossman, and the lads took to cooling off with a drink made of local products; limes, rum and sugar. One week end in Santiago, word was passed to the bartender at the Venus hotel, and Jennings S. Cox, chief engineer, suggested the name.

Item number two evokes a feeling not so much of cheer as of brotherhood with, of all people, the Gilbert & Sullivan Society of London. We recently learned that the true followers of G&S have been more than a little troubled as they looked forward to the year 1962.

After that date, the Savoyards note with great misgivings, the collected works will no longer enjoy their traditional protection of ownership rights, and stand in peril of presentation by promoters and producers who might tamper with the original material to a point of desecration.

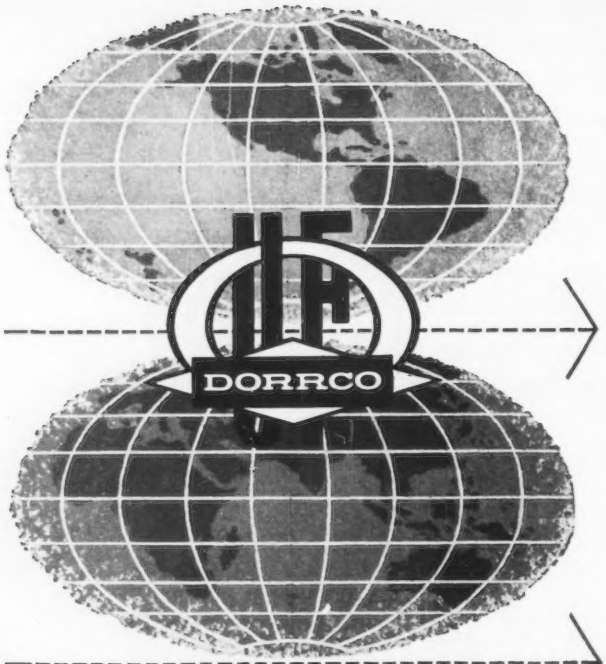
Maybe we could get lapel buttons made—"Worried about '62? Me, too."

Item number three (and our favorite) is both consoling and reassuring. It is a direct quote from "Careers in the Mineral Industry," a booklet written by J. Donald Forrester and John Cameron Fox, of the University of Arizona and AIME, respectively. The quote . . . "Sex is no bar to success in the minerals industry." Thank Heaven for that!

THIS IS MARION QUALITY

Let's face it. After all the advertising claims...after the paper work...the cost-and-profit-per-ton analyses...the final acid test takes place here—on the job. So, let's take a look at Marion Quality in action. The job: A huge dam project. The machines: Four Marion excavators with a total dipper capacity of 48 cubic yards. The performance record: MORE DIRT WAS MOVED (BY THE LOAD AND HAUL METHOD) THAN ON ANY OTHER SINGLE EARTHWORKS JOB ANY PLACE IN THE WORLD IN A 24-HOUR PERIOD BY ONE CONTRACTOR! It only proves one inescapable fact. There *is* a difference between promising — and — delivering bigger profit margins. And that's true whether you're interested in high output, such as this construction job demands, or sustained performance on a low cost per ton basis in the copper and iron ore countries. We have the performance figures to back up both. Marion Power Shovel Company, Marion, Ohio. A Division of Universal Marion Corporation.

MARION



1960 has been a year of significant technical gain and measurable improvement in overall incoming business volume. In technology, a selective concentration of our development effort has begun to show results. Some of these new units and processes currently being marketed are mentioned below. Others, several of which show considerable commercial as well as technical promise, are nearing fruition and should be available during 1961. Progress in basic product standardization and redesign has also played a significant part in our technical advance and will have a substantial effect on our ability to serve our customers.

Virtually every segment of our worldwide operations has contributed to the increased volume of new business with an unusual degree of activity on exceptionally large projects apparent in many areas of the world. This overall gain has been reflected in somewhat higher billings and profits but a substantial increase in backlog has been the primary result.

METALLURGICAL—During the past year, the first installation of the new Dorr-Oliver DSM Heavy Media System went into operation on iron ore beneficiation in Minnesota. This process utilizes a DorrClone unit as the heavy media separatory vessel and other newly developed D-O units in the media cleaning circuit. As compared with conventional practice the new system provides better media cleaning, improved recovery and grade of ore and sharply reduces magnetite losses.

Included in the flowsheet is the D-O SiphonSizer, a hydraulic classifier operating on the hindered settling principle. In limited use for several years, this unit is now being applied in the metallurgical and non-metallics fields on both a commercial and experimental basis where sharper classification is of benefit.

For water conservation, one of the largest center pier Dorr Thickeners to be built in recent years is soon to go into operation for a major copper producer. Overall diameter of this unit is 375 feet.

NON-METALLICS—The continued installation of varied D-O equipment in wet process cement plants throughout the world has reflected the expansion of this industry, particularly in South America. It is interesting to note that in this latter area several Dorr Slurry Mixers in the 100 foot dia. range are being installed. These are among the largest ever fabricated.

A new development of significance in the cement industry was the introduction of the 270° DSM Screen —a unit which has increased grinding mill capacity when used for closed-circuiting or scalping. Considerable operating experience is available from several installations in Australia and Europe.

Substantial flowsheet improvement in phosphate rock beneficiation and coal washing has resulted from the application of sharper classification in Dorrco Hydroscillators and Sizers. The Oliver Horizontal Filter and the Dorrco FluoSolids System have been successfully operated in combination.

FOOD & PHARMACEUTICAL—In food and pharmaceutical industries, highly efficient separations coupled with economies in operating costs and space continue to attract processors to Dorr-Oliver centrifugal equipment. In the starch industry, for example, Merco Centrifuges, Mercone Screening Centrifuges and DorrClone Systems were selected in various combinations for expansions, modernizations and new plant facilities in Argentina, Mexico, the Philippines, South Africa, Uruguay and the United States.

Food processors also discovered the advantages of the DSM Screen and began to apply them to various dewatering jobs, such as germ separation, fibre washing and pulp removal from waste process waters. A new rotary vacuum filter of plastic construction, with interesting cost savings over stainless steel, performed well on clarification of fruit juices. Small diameter DorrClones in porcelain construction also solved speck and seed removal problems in various juice lines.

A leading manufacturer of new, high protein products for food and industrial use has utilized D-O equipment and services in developing new, continuous processes.

CHEMICAL—The versatile Oliver Horizontal Filter was applied to the washing and dewatering of a number of granular chemical products. A major breakthrough in the thermal drying of nitrocellulose by a special design of the Oliver Horizontal Filter resulted in substantial reduction in operating costs with a significant advance in safety. A multiple and repeat installation

of Horizontal Filters for phosphoric acid production was ordered late in 1960 from a major producer.

The newer unit operation of centrifugation continued to prove its potential in the field. Typical examples of its application are the successful use of Mercone and DorrClone units for carbon removal from paraffin oil and of a Merco Centrifuge for the removal of impurities from phosphorus.

PETROLEUM & PETROCHEMICALS—A new development of importance during 1960 was the application of the Mercone Centrifuge to the removal of liquids from polymer crumbs. One of the most exciting developments was the success of a special 'clamshell' DorrClone for catalyst removal from cat-cracker-fractionator bottoms. This solves a long standing refinery problem and should have wide application.

The Synrub filter is still an accepted standard in the processing of synthetic rubber both in the United States and elsewhere in the world. As an example, South America's first synthetic rubber plant, which was built during the year in Brazil employed a multiple D-O Synrub filter installation.

In the field of petroleum production, a principal D-O activity continued to be the use of DorrClone desanding and degritting units in water injection and drill mud conditioning. These are also now being applied to degritting of crudes.

The high demand for paraxylene has been partially solved by the application of a Merco Centrifuge separating paraxylene from a xylene stream at —80° F. Higher recoveries are achieved than ever before.

PULP & PAPER—The continuing increase in paper demand in every part of the world has resulted in the sale of brownstock washing, recausticizing and pulp bleaching systems both in the United States and abroad. Filters, pumps and sedimentation equipment have also been in demand for both pulp processing and such accessory services as water and waste treatment.

A significant advance in pulp bleaching by chlorine dioxide, the D-O concentric bleaching tower was made available broadly to the industry this year. The first of these towers has completed a year of highly successful operation in Idaho; the second will be in operation early this year.

Close cooperation and attention resulted in the supply of substantially all equipment for additional brownstock washing and bleaching sections at the newest mill in the Northwest.

MUNICIPAL AND INDUSTRIAL WASTE TREATMENT—Interest was extremely high in activated sludge treatment and applicable new D-O developments continued to gain momentum. The D-O Aerator was applied to the treatment of combined strong domestic and industrial wastes in municipal plants. Late in the year, the D-O Inka Aerator was introduced. Developed in Sweden and widely used in Europe, it combines high oxygen absorption rates with low power requirements and can be used most effectively on low BOD waste.

Programs conducted in the field on Densludge thickening and digestion were reported in detail during the year. One major city expects to save $6,000,000 in its current plant construction program through the use of this technique. In another interesting application, the Sultzer Disintegrator has improved digester performance in one large municipal plant when used to grind the thickened sludge.

Successful demonstrations of the RSR Clarifier proved the efficiency of this new unit for separating high volatile return sludge from waste sludge. Also, the use of the SpiroVortex System for the activated sludge process was further exemplified by a new installation in California.

In the area of sewage sludge dewatering, Dorr-Oliver Plastic Filters proved successful at Westport, Conn., and Paw Paw, Mich., while new filters of conventional design were installed at Harrisburg, Penna., and Marshall, Miss.

WATER TREATMENT—An outstanding event of the year in water treatment was the completion of the five-year construction program at Philadelphia's ultra-modern 423 mgd Torresdale plant for which D-O supplied four Dorrco Flocculators, and four Dorr Squarex Clarifiers. Another outstanding municipal water treatment plant is under construction by the Metropolitan Water District of Southern California. This plant will incorporate sixteen Dorr Squarex Clarifiers.

In the area of recent developments, a new Dorrco PeriFilter System will shortly go into operation at a southern city to treat 4.0 million gallons a day, and successful pilot plant demonstrations of an improved lime sludge handling method were carried out in several mid western cities. An increasing number of DorrClone units for desanding well water are being installed to protect meters and valves in industrial and municipal water supply systems.

Worldwide activity in new industrial plant construction, particularly in the pulp and paper field, has resulted in much activity in the application of both Hydro-Treators and conventional pre-treatment units to industrial water treatment.

PROJECT ENGINEERING — Much of the activity in this sector of D-O operations was provided by the rapidly expanding fertilizer industry. This included plants for the beneficiation of phosphate rock and for the production of phosphoric acid, ammonium phosphate, triple superphosphate and complete granular fertilizers. Typical of this area of activity are two phosphoric acid plants now being designed by D-O in Florida on a turnkey basis. A plant of unusual interest is being designed to recover ilmenite from heavy, mineral bearing sands for the ultimate production of titanium. D-O engineering includes the processing equipment, all auxiliary facilities and structures.

Other engineering projects include beneficiation of iron and copper ores, recovery of copper scrap, and facilities in such diverse fields as the pulp and paper industry, nitrocellulose manufacture, and starch production. Geographically, projects are underway in Africa, Brazil, England, France, Germany, India, Ireland, Japan, Jordan, Mexico and Yugoslavia as well as the United States.

FLUOSOLIDS SYSTEMS—1960 was a year of unusual activity involving both new and thoroughly demonstrated applications of fluid techniques. Plants for drying fine coal and both the drying and calcination of varied metallic and non-metallic ores continue to be in demand and contributed substantially to overall volume.

In the realm of the new and unusual—an important plastics plant went into production during the year utilizing a Dorrco FluoSolids System to dry the product Other similar applications are in the development stage. Another unusual application involving the roasting of copper concentrates for partial removal of sulphur prior to smelting will go into operation early in 1961. Also in 1960 a major chemical manufacturer ordered a third FluoSolids Reactor for processing food additives.

Of particular interest is a 200 ton per day lime plant scheduled for completion in mid 1961 in Florida. It is being completely designed and engineered by D-O on a turnkey basis with FluoSolids Reactors utilized in both the key steps of limestone drying and calcination.

SUGAR—Two new D-O developments were introduced to the Cane Sugar industry during 1960.

The D-O Rapi-Floc System introduces a controlled flocculation step before filtering of cane mud on a modified Oliver-Campbell Filter. The second development involved the application of DSM Screens to juice screening, with improved clarification and filtration reported as a result.

Throughout the year there has been a continuing demand for RapiDorr Clarifiers, Oliver-Campbell Filters and other standard Dorr-Oliver equipment for both new and expanded cane sugar mills, with the Middle East, Far East, Africa and Latin America particularly active.

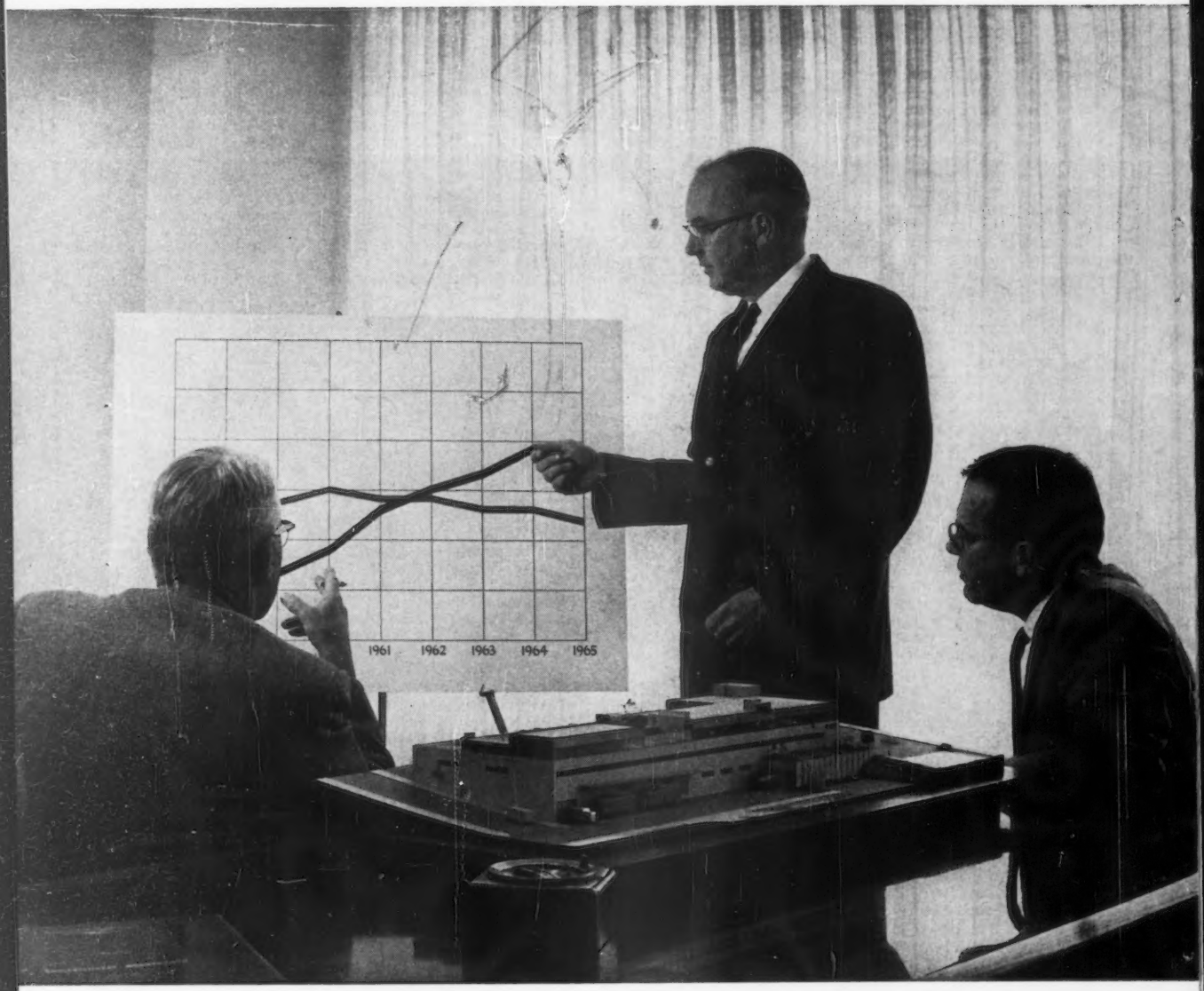
We have several challenges ahead. We must provide our customers with even greater technical competence and service. We must continue to improve our profit structure to provide the income we need for continued technical and corporate growth in the future. We must provide growth and stability by adding to our product lines and areas of activity.

Through the dedicated efforts of our staff around the world we have made substantial progress in these areas during the past year. I am confident that this progress will continue and accelerate in the months ahead.

L. R. BOLING
President

December 1, 1960

Pre-Engineering by **KAISER ENGINEERS** answers basic plant expansion questions...



Profitability? Faced with the decision to expand your plant facilities, you should first determine whether all elements combine to form a pattern of future profitability. Independent analysis of all aspects of your proposed program is the *Pre-Engineering* service offered by Kaiser Engineers. The studies and evaluations furnished by KE Pre-Engineering represent only one phase of total KE services. Kaiser Engineers is an experienced designer and builder of all types of facilities for the Minerals industry. From Pre-Engineering through design and construction, Kaiser Engineers provides complete one-company service and ingenuity based on years of experience.

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GOODYEAR

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1 NEW SHREDDED WIRE UNDER-TREAD gives better resistance to cuts and punctures—dissipates heat—reduces separation (by providing improved adhesion between tread and carcass)—retards cut growth—serves as a "cushioning bridge" between the carcass and the tread. RESULT: a much tougher, more solidly built—longer-lasting tire!

2 EXTRA-THICK TREAD—fully 50% thicker than the regulars—means longer tread life. Nonskid tread is up to 71% deeper too. RESULT: outstanding mileage and traction!

3 NEW HEAT-RESISTANT COMPOUNDS are also available! They protect against heat build-up. RESULT: Longer life on longer hauls at higher speeds!

4 EXCLUSIVE 3-T PROCESSED NYLON CORD is triple-tempered—like steel—by Tension, Temperature and Time. RESULT: bruise-breaks and blowouts are reduced to an all-time low!

NEW HARD ROCK LUG XTRA TRED

is now fortified 4 ways!

Artist's conception of Hard Rock Lug Xtra Tred rear tires hauling limestone for cement production in Calaveras County, California.

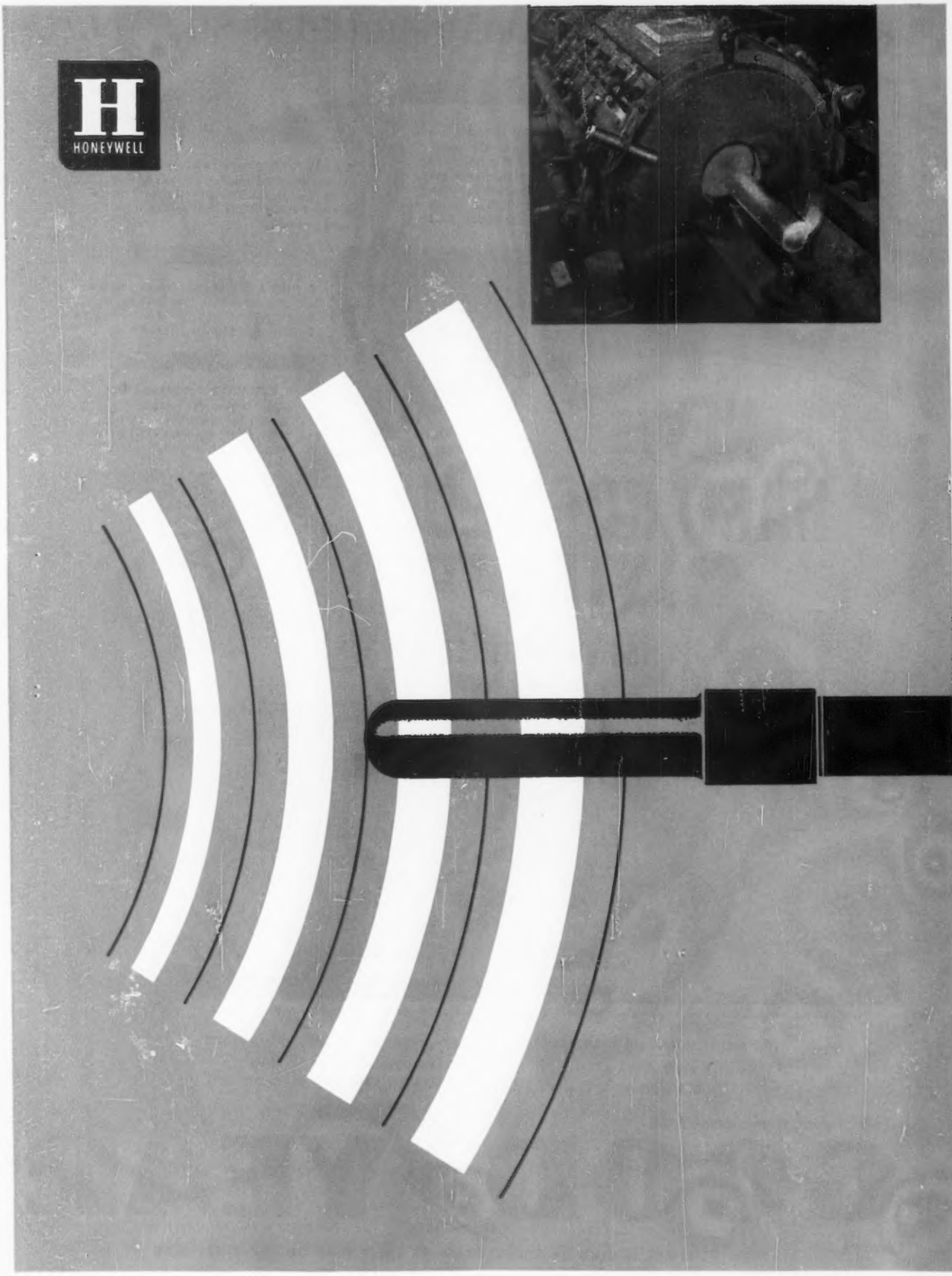
Give your equipment *and* your profits the super-protection of super-fortified Hard Rock Lug Xtra Tred tires. See your Goodyear dealer—*today!*
Goodyear, Truck Tire Dept., Akron 16, Ohio.

Lots of good things come from

GOODYEAR

Xtra Tred—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND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For more than 20 years, *Radiamatic* Infrared Systems have been giving reliable, accurate service in every area of industrial temperature measurement and control. Over the years Honeywell has developed special infrared techniques and equipment for a wide range of applications, including heat treating furnaces, soaking pits, induction heating and melting furnaces, forging furnaces, high-speed salt baths, kilns, and many others.

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A complete line of Honeywell instruments and accessories assures you of both economy of selection and a control system tailored exactly to your temperature requirements.

Your nearby Honeywell Field Engineer will be glad to discuss your temperature measurement and control problems with you. MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pennsylvania.

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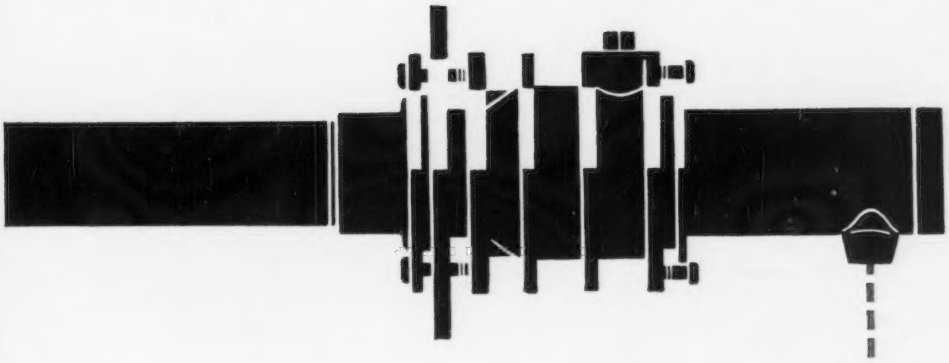
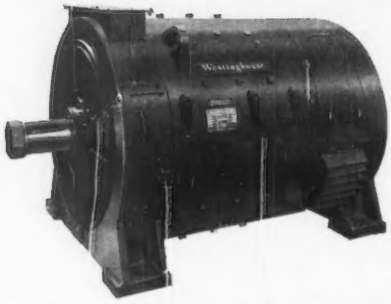


24 Westinghouse Main Drive Motors and Control to Power Largest Mobile Land Machine Ever Built

14,500 Horsepower to Drive Bucyrus-Erie's New 14,000,000-Pound Giant Shovel for Peabody Coal Co.



Main drive d-c motors and M-G sets have exclusive Westinghouse Thermalastic® insulation, exceedingly stable and resilient, to withstand electrical thermal shock variations encountered in shovel service. Tough, low-inertia d-c motor armatures make possible very fast starts, stops and reversals.

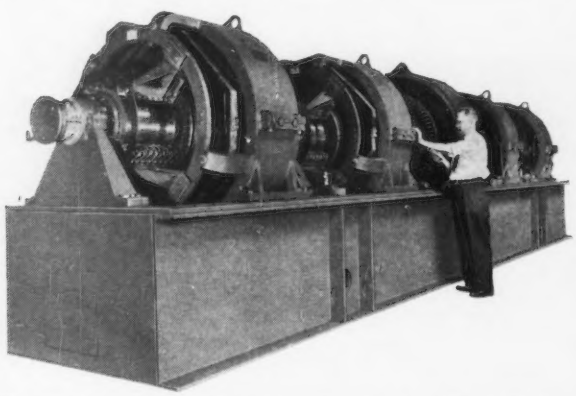
Westinghouse electrical equipment —powerful, fast and reliable—will drive this huge shovel. For digging there will be eight 625-hp d-c hoist motors, six 500-hp d-c swing motors, and two 500-hp d-c crowd motors. A separate d-c generator will power each motor. The generators will be assembled into four M-G sets, each driven by a 3000-hp synchronous motor. Eight 250-hp a-c motors will power the crawler propel drives. Dozens of smaller motors will power various auxiliary drives.

Modern Magamp-exciter control provides smooth performance and fast response of the main d-c drives with minimum current overshoot. Flexible and easily adjustable, this control permits selection of optimum motor performance characteristics needed for any particular digging condition.

With Westinghouse Magamp-exciter control for the hoist, swing and crowd, the huge machine will have a 50-second digging cycle. Loaded dipper speeds during swing will reach 25 miles an hour; the boom will accelerate to top speed in eight seconds and decelerate to zero speed in four seconds. Westinghouse drives will be built to maintain this demanding performance continuously, withstand extreme vibration and still develop over 200% of rated loading whenever required.

You can be sure... if it's Westinghouse

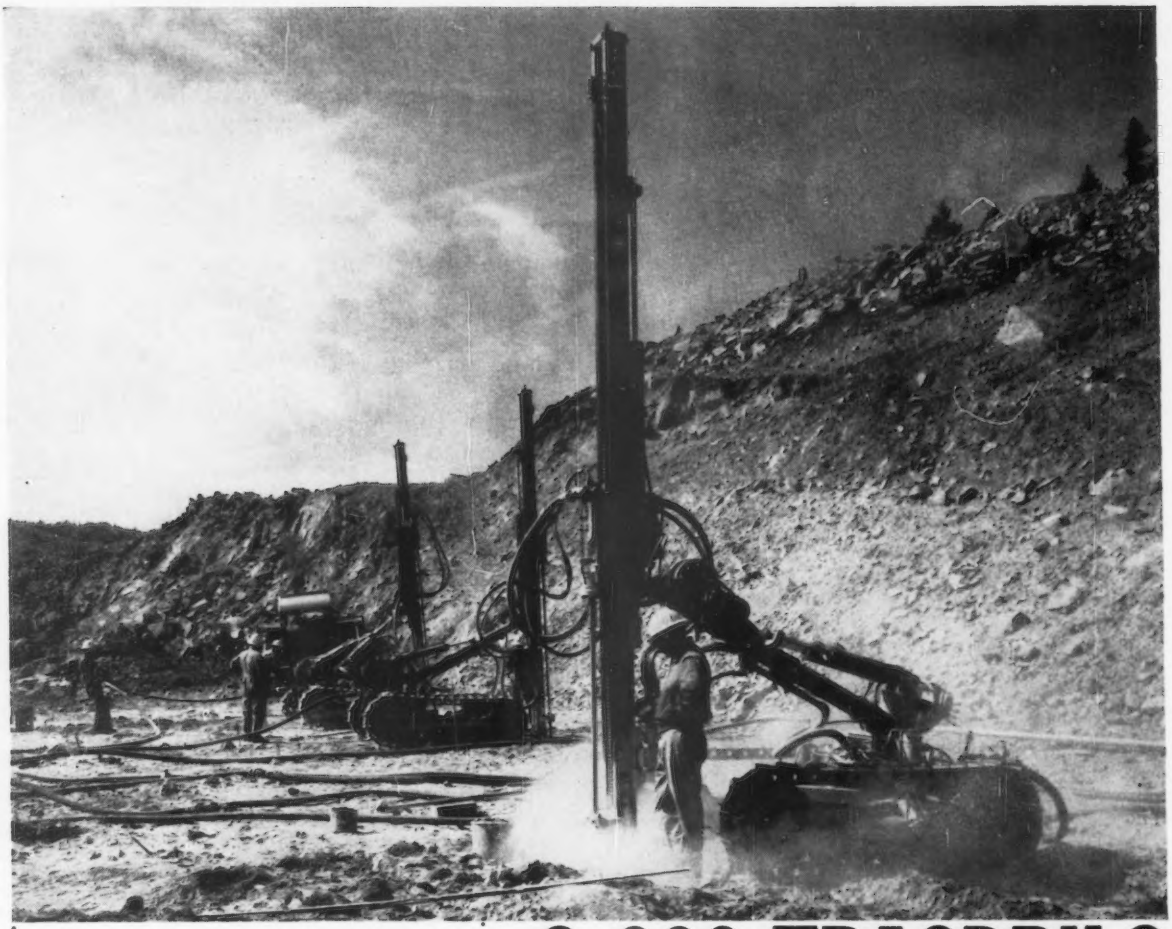
J-96159



World's largest shovel motor-generator sets have these design features—Heavy-duty, self-aligning, spherical seat pedestal sleeve-type main bearings and double-ball end thrust bearings —permitting operation at as much as 10° tilt. Extremely heavy and rigid self-supporting bedplate—insuring that rotating units will stay in correct alignment even under heavy shock stresses and vibration transmitted from shovel structure.

Westinghouse

New Bucyrus-Erie electrically driven strip mining shovel for Peabody Coal Company will weigh 7000 tons, more than Juneau Class Navy cruiser . . . will tower 213 feet high with 450 feet working range. Mammoth 115-cu-yd dipper is 64% larger than any built to date . . . will move over 200,000 tons of overburden per day, making possible mining of 4,000,000 tons of coal per year.



ABOVE: G-900 TRACDRILS with "Hydra-poise" knee-action have unmatched maneuverability and stability to sink blast holes in any formation. Independently operated, extra-long crawlers provide 1350 square inches of ground contact. Two sets of grouped controls—one at turret, the other at boom end—save time and steps for driller.

BELOW: A battery of "POWER VANE" ROTARY COMPRESSORS, supplies air to a group of G-900 Tracdrils on a big project. Used singly or in batteries, "Power Vane" Rotaries have the "Go-Power" you need to keep your air-powered equipment producing at full capacity.

G-900 TRACDRILS

are at their best in the toughest terrains and formations

...let their power and stamina deliver more blast holes per shift for you! Mention treacherous footing and hard rock and you've got a job for Chicago Pneumatic G-900 Tracdrils and "Power Vane" Rotary Compressors.

Operators find the new G-900 a mining man's drill. It's got everything a driller expects from a high production rig... plus some real exclusives, too! It can drill directly alongside tracks with 180° full boom swing. It handles horizontals 11 feet high at the face, or snake holes at ground level. And you can't beat the G-900 for safety. Release the throttle and heavy-duty brakes lock automatically... keep drill from shifting or creeping... hold hard on really bad ground.

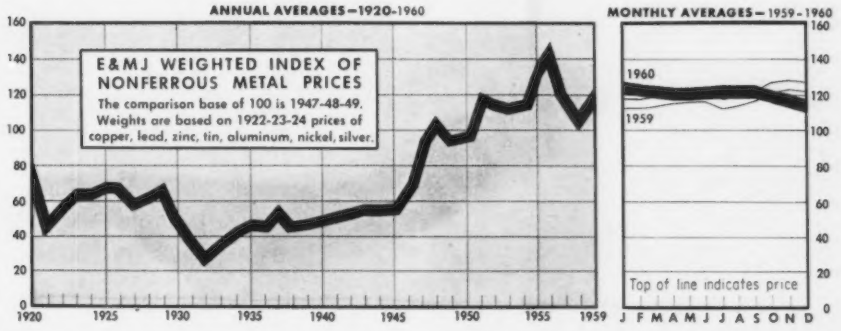
Backed up by rugged, always reliable CP-600 "Power Vane" Rotary Compressors with the "Go-Power" to meet every air demand, you can lick the toughest formations you'll ever find. Write for your copy of the new bulletin SP-3267 on the revolutionary G-900 Tracdril. *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, New York.*

Chicago Pneumatic

TRACDRILS • AIR COMPRESSORS • PNEUMATIC TOOLS • AIR WRENCHES • REICHdrills

E&MJ OUTLOOK

PRICES



MARKETS

Lower average prices for lead, zinc and tin dropped the E&MJ nonferrous metals average from 120.2 in November to 118.7 in December.

AT HOME

W. A. Sterling, chairman of the board, Cleveland-Cliffs Iron Ore Co., notified employes that the company would have to restrict iron ore production in 1961 because of competition from high-grade foreign ores, which enjoy cheaper labor rates, more favorable tax considerations and lower foreign shipping rates.

Free World nickel consumption totaled a record-breaking 500-million lb during 1960. International Nickel Co. expects a high consumption rate to continue through 1961.

U.S. gold bullion losses during 1960 totaled $1.9-billion, the second largest annual outflow in history. Treasury stocks at the end of 1960 were $17.8-billion, lowest since 1940.

American Mining Congress has adopted the following policy recommendation: That the "Government give immediate recognition to the increased costs of producing gold within the United States by means of an increase in the price paid to domestic producers of newly-mined gold."

LABOR

Most significant labor development during 1960 was the settlement of the Bunker-Hill strike in Idaho through a new bargaining agent, the Northwest Metal Workers Union, which ousted Mine-Mill by a vote of 672 to 621. The seven-month strike had idled some 2200 workers.

ABROAD

A U.S. manufacturer and Russian researchers have independently developed an electro-hydraulic device which breaks and drills rocks by shooting high-voltage sparks at rock surfaces under water.

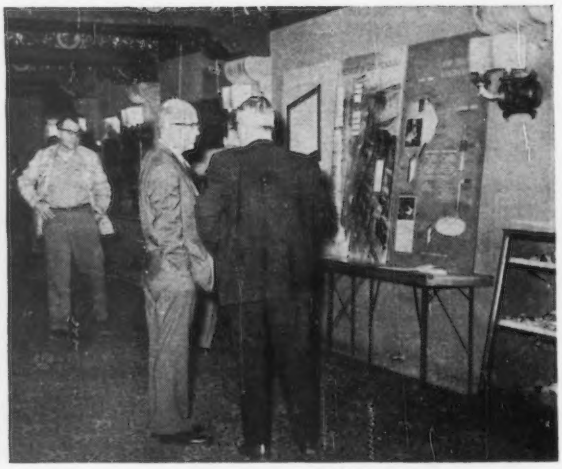
The Portuguese Minister Council has approved a $45-million order to Krupp, in Essen, Germany, for railway, mining and ore loading equipment to be used in iron ore and manganese projects in Angola.

A Soviet turbo-drill with plastic working parts has proved 20% more efficient than drills equipped with metal parts.

Nchanga has started a £3-million program to install a roasting plant and increase leaching plant capacity by an additional 1,000 tons per month. Second-stage plans call for additional leaching facilities to treat low-grade copper-oxide concentrates and additional electrolytic capacity in the tank house.

Reynolds Metals Co. and the Venezuelan Government have signed a contract providing for the construction of a $30-million aluminum plant. Initial capacity will be 25,000 tons per year, 80% of which will be consumed in Venezuela. Power will come from the Government's hydroelectric plant on the Caroni and Orinoco rivers.

THIS MONTH IN MINING



THREE PROGRAM LEADERS deep in discussion of the resolutions were J. C. Kieffer, Asarco's manager at Wallace; John Edgar, general manager of mining at Sunshine Mining Co., and E. C. Stephens, head of the Spokane office of Anaconda. A number of displays (right) lined the hallways of the Davenport Hotel, where registration set a record of 936.

NWMA Discusses Gold, Hears of Area Progress

A SERIES of sweeping changes in U.S. monetary policies was called for at the 66th annual convention of the Northwest Mining Association in Spokane Dec. 2 and 3. The sessions, which drew a record registration of 936, were at the Davenport Hotel.

A special session of the convention on monetary problems emphasized growing concern over the nation's gold and silver policies. Expressing alarm over the flow of gold abroad and excessives sales of silver by the treasury, a key resolution adopted by the convention asked:

1. The removal of all restrictions on the ownership and trade in the precious metals.

2. Cessation of treasury sales of silver at less than the statutory price of $1.29 an oz.

3. Revision of the Federal Reserve structure to require an increasing metallic reserve against note and deposit liabilities, with the ultimate object of achieving a fully-backed currency.

4. Prompt restoration of full domestic as well as foreign convertibility of the dollar at a rate indicated by the free market value of gold.

5. Treasury execution of the policy declared by Congress in the act of June 19, 1934, that silver monetary stocks of the U.S. should be brought to and maintained at one-fourth the total monetary stock of gold and silver.

6. The government give immediate recognition to the increased costs of producing gold within the U.S. by means of an increase in the price paid to domestic producers for newly mined gold.

The resolution declared that the domestic gold and silver mining industry is on the verge of extinction and contended that U.S. monetary policy is no longer under control of the Federal Reserve system or the treasury; the decisive power is in the hands of foreign central banks, which command more claims on U.S. gold than is held by the treasury.

"The integrity of the dollar," the resolution pointed out, "which is the principal reserve of the free world currency, has become subject of world-wide anxiety. Immediate measures are demanded. Only an impregnable dollar can serve the world-wide responsibilities which the U.S. has assumed. A fractional reserve system, as designed in 1913 for a domestic monetary system, is obsolete for the times. A fully gold and silver backed currency would withstand the shocks to which the dollar is subject."

Similar views were voiced by Dr. Elgin Groseclose, Washington, D. C., economic consultant, one of four speakers at the "Gold, Silver and Money session." He said a great power like the U.S. cannot afford to trust its prestige and huge responsibilities to what he termed the "uncertain seas of fiat money." Groseclose urged a gradual rise in the reserve ration until currency and deposit liabilities are fully covered by gold. He blamed the nation's gold drain on a monetary system which he said was inadequate to meet the world wide strains placed upon it.

Franc R. Joubin, president of Bralorne Mines, Ltd., Vancouver, B. C., a major Canadian producer of gold, declared that gold production should be encouraged because more of it is needed for an expanding economy. He said the gold mining industry is drying up. Two-thirds of the Free World's output of gold is from Africa, which he called a "most precarious supply."

Joubin said that a U.S. subsidy for domestic gold producers would put Alaska on a solid economic foundation and would help allies, such as the Philippines.

John Edgar, general manager of the mining division of Sunshine Mining Co., Spokane, operator of the nation's largest silver mine at Kellogg, Idaho, declared that in the last 10 years the U.S. has consumed over 1-billion oz more silver than it produced. He said that production of silver will continue to decline until the "Treasury-imposed ceiling" on the world silver price is removed.

Alarm over monetary policies and the gold situation was in the forefront of problems discussed at the convention, but still emphasized at the meeting was the plight of the Northwest's "bread and butter" lead-zinc industry. Clark L. Wilson, chairman of the Emergency Lead-Zinc Committee, Washington, D. C., said that while quotas may be effective if properly set, the long-term solution to the problem of the domestic miner is import tax legislation "to provide the domestic producer with a fair share of the market at a reasonable price, protect the consumer from prices so high as to invite substitution, and still allow necessary imports without penalizing the importing country."

"Our proposals, sponsored by Mrs. Pfost (Rep. Gracie Pfost, D-Idaho) and Sen. Bennett (Sen. Wallace Bennett, R-Utah) for an adequate removable tax plus increased duties on manufactured items will do this," Wilson said. He added that the administration had opposed these efforts.

Wilson said that the solution to the problems of the domestic miner is complicated by the natural divisions within the industry: 1. the small mine producing a few thousand tons of lead or zinc each year, 2. the intermediate-sized

mine—with or without a mill—producing a larger tonnage, and 3. the integrated domestic companies with mines, mills and smelters.

"I'm convinced that there must be a new 1961 legislative approach and it must, in a sense, be "double-barrelled" to accommodate the various industry divisions, with a limited subsidy to provide immediate, effective help to the small and intermediate-sized miner and a tax plan that will provide long-term market stability for all.

"While we wait for the factors of production, consumption, costs and market price to equalize the world situation up to our standards, controls will be required, and the Emergency Lead-Zinc Committee fully intends to continue its program for legislation that will give the domestic lead-zinc miner a fair share of the domestic market at a price reasonable to the producer, consumer and importer," Wilson said.

An optimistic prediction that new uses being found for zinc could double its market was made by Angus Y. Bethune, manager of metallurgy for Bunker Hill Co., at Kellogg, Idaho. Bethune and Wilson were among the speakers at the opening session of the convention. Another was Marling J. Ankeny, director of the U.S. Bureau of Mines, who described recent experiments in underground hydraulic mining that have been conducted by the bureau. Based on experiments conducted in Pennsylvania coal mines, Ankeny said the bureau has great hopes of developing a low-cost underground mining method using high pressure water to replace drills and loader-scrapers.

A Dec. 2 luncheon session featured a descriptive talk on the St. Joseph Lead company's new Viburnum operation in southeastern Missouri. Speaker was Elmer A. Jones, division manager for the company at Bonne Terre, Mo. (see p 65).

Use of the syndicate method of financing to enable some small Canadian mining firms to conduct mineral exploration programs was outlined in a paper prepared by Karl J. Springer, president of the MacKenzie Syndicate, Vancouver, B.C. He said that under the plan, up to six parties have joined to provide financing of a venture which normally only larger mining firms could afford. His paper was presented at a Canadian session Dec. 2, which also included a paper by H. L. Hill, Vancouver, B.C., consulting engineer, on "Camp McKinney, A Small Gold Mine in British Columbia."

A cooperative geologic project in northwestern Montana, sponsored by the Montana Bureau of Mines and Geology, Pacific Power and Light company and the Great Northern Railroad Co., was outlined by Willis M. Johns, geologist for the bureau. The $60,000 survey, started in 1958, will include mapping of nine 30-minute quadrangles enclosing about

(Continued on p 110)

As We Went to Press . . .

Johns-Manville Corp. began production in December 1960 at its $1-million, five-level perlite mill at No Agua, N.M. The mill will process about 150,000 tpy of perlite ore mined from a surrounding 2000 acre property. Since severe winter weather in the northern New Mexico mountains hampers surface mining operations, perlite ore will be stockpiled during the warm months for winter work. According to company officers, the No Agua site has perlite ore reserves which should last "well over 100 years."

Cominco will spend $3-million in a reorganization of the Trail zinc treatment system. Vice president Ralph D. Perry said that the smelter slags which the plant has been processing for several years to produce about 75 tpd of refined zinc will be exhausted by 1962. The residues have been treated through an oxide leaching plant.

The new system will consist of a new roaster and attendant gear to process sulphide concentrates from company mines, which will be brought in to replace the depleted stockpile.

Bunker Hill's $2-million phosphoric acid plant will start production early this month, with all acid under contract to the Los Angeles firm of Collier Carbon Co. The plant was completed last spring, but a 7½-month strike held up production.

American Zinc, Lead & Smelting Co. will reopen its Cardin, Okla. zinc mill in March. The "Barbara J." will operate at about 25,000 tpm of ore by mid-year, according to the firm, on ores trucked from nearby independent producers.

Beryllium Resources, Inc., has organized a subsidiary company, Beryllium Resources de Mexico, S.A., which will explore, mine, and concentrate beryl ore in Mexico. In order to finance the beryllium development work, Beryllium Resources de Mexico has leased and is now working the Ensenada, previously known as the Princessa, mine.

Gold production at Ensenada, a mine which had been abandoned by its former owners because of serious flooding, has been trebled from its starting figure to 180 yards per day, with values averaging $5-per-yard. All profits from the Ensenada gold workings will remain in Mexico for development of the country's beryllium mining facilities.

Vast mineral resources, previously claimed by the Red Chinese, have been further substantiated by members of USGS. Among the mineral deposits listed by Dr. Edward C. T. Chao were vast molybdenum and ilmenite deposits, and two huge iron ore deposits; one of 7-million tons in the Shansi area, and a second, with 3-million tons, in Honan province.

Kennecott Copper Corp. has acquired patents on a new acid process for production of high grade molybdenum oxides from low grade concentrates. In the process, credited to Dr. S. R. Zimmerley and E. E. Malouf, molybdenite concentrates are roasted for partial elimination of sulphur and reacted with H_2SO_4 at approximately 700° F in a rotary furnace, converting the moly into a soluble material. Water treatment then separates the product from the insoluble residue. Ion exchange would follow.

WASHINGTON IMPACT

Highlights

A NEW ADMINISTRATION—The changeover in Washington this month promises to be one of attitude, approach, and emphasis in the big business of shaping Federal policies, rather than any dramatic shift in goals or basic philosophies of government. This is evident in the "moderate liberal" tag already being applied to the new Administration so far.

This does not mean that there won't be significant effects on many segments of the nation. There will. A rundown on the outlook for some of the policy issues affecting the metal-mineral mining industries follows below. But there are two important factors that will work against a Franklin Roosevelt 100-days era in the months ahead. One is the conservative make-up of the new 87th Congress. The other is the basic inclination of President John F. Kennedy and his top officials and advisers to prepare the way for new programs slowly and carefully.

FROM THE WHITE HOUSE. . . Kennedy will use his personal energy and talents to play a leading role in making, as well as approving national policies. His attitude toward domestic mining, as compared with the Eisenhower approach, will put more emphasis on the need to improve economic conditions generally for the producers who turn out products the Administration judges essential to over-all U.S. requirements. There will likely be less attention paid to individual interests, or segments of the industries which policymakers regard as non-essential.

Specifically, Kennedy will oppose one-shot trade protection relief for individual commodities. His over-all program will be one of freer trade, probably more so than Eisenhower's. Particularly in the case of raw materials, Kennedy is eager to align the U.S., economically and politically, with underdeveloped nations producing commodities, in some instances highly competitive with domestic output. Nor does he favor any reduction of U.S. foreign aid or private investment in those areas. He also is considering new international commodity marketing and production agreements, perhaps on a regional basis.

On the other hand, Kennedy is likely to push hard for extensive new domestic research and development aid in the metal-mineral field, especially in those commodities which the U.S. does not have readily available from foreign sources.

Kennedy also is expected to push for some new subsidy programs and tax benefits for domestic mines, partly in place of import protection, partly to stimulate the domestic economy generally.

. . .THROUGH THE EXECUTIVE DEPARTMENTS—the key metal-mineral policy men in the Kennedy Administration will be Interior Secretary Stewart Udall, along with his probable Assistant Secretary for Mining Robert Redwine (E&MJ—December 1960, P. 25), and, to a lesser extent, Commerce Secretary Luther Hodges. All are on record in favor of stimulating domestic mine production. On trade policy, key cabinet and sub-cabinet policymakers at State Department and Commerce Department will continue to head the opposition. But proposal of a program of "trade adjustment" subsidies to domestic producers injured by import competition is a good bet. Udall, who is reading former Interior Secretary Harold Ickes' biography, is reported to be eager to come up with new Federal government projects to aid domestic mining.

Redwine, if named, will see the passage of a national minerals policy as one of his first tasks. And, like Kennedy, he was for the small lead-zinc mine operators price-support subsidy law, vetoed by President Eisenhower.

. . .TO CONGRESS—on Capitol Hill, the 87th Congress is expected to be friendlier to domestic mines than its predecessor, and probably more so than the new Administration. Sen. Clinton Anderson (D-N.M.) is in line to head the Interior Committee, succeeding retiring Sen. James Murray (D-Mont.). Rep. Wayne Aspinall (D.-Colo.) will remain as chairman of the House Interior Committee. Both favor new minerals programs.

International Controls Backed by Interior

International commodity controls, one of the new Administration's key policy considerations (see Highlights this page), got a qualified boost from the Interior Department last month—at least as they apply to lead.

A further reduction below a 1959-60 voluntary 10 per cent world production cutback "seems necessary," the Department commented in an annual review on lead and zinc.

Free World zinc output, on the other hand, should be restricted, the government agency urged.

Lead and zinc controls have been the subject of a continuing producer-consumer nation committee, under the aegis of the United Nations since 1958. It was this group that led to the voluntary cutbacks in lead announced in 1959. The same group refused to recommend mandatory controls under a formal international agreement.

The Interior Department report, noting that production of zinc is expected to increase in 1961, said no multilateral production restrictions appear called for.

Last year, the report stated, domestic U.S. consumption of both metals dropped below 1959. Lead was down 4 per cent to 1-million short tons, zinc off 9 per cent to 860,000 tons.

Production of both metals was up world-wide, with domestic lead production increases more than offset by a drop in imports because of current U.S. import quotas on both metals.

Continuation of import quotas on lead and zinc will be a delicate question for the new Administration to tackle. Last month, the White House accepted a Tariff Commission recommendation to keep curbs on both metals in effect for at least another year. Earlier, the Commission was toying with the idea of recommending a relaxation of zinc import quotas, possibly replacing them with higher tariffs instead.

Kennedy Plans Include "Indirect Aid" Money

Indirect aids to domestic mines and other U.S. businesses are under active consideration by the new Administration. These are aside from the specific mining programs Washington may come up with this year.

One is the almost sure bet that the White House will win its legislative battle for an aid to depressed areas appropriation. A $251 million request was passed last year, but vetoed by President Eisenhower.

In some ways, this would work much the same as proposals for trade adjustment subsidies to domestic producers injured by foreign import competition.

The money would be used by indus-

try to either stimulate current business or expansion in the area, or to start new ventures, not necessarily in the same business.

Another indirect aid is in prospect through state governments getting more money from the Kennedy Administration for unemployment compensation—"jobless benefits"—under their own local programs.

The last time states turned to the Federal Government was in 1958. This year they may wear a heavier path to the Treasury door.

Gold Flow Issue Adds To Trade Arguments

THE BALANCE OF PAYMENTS "crisis" pervades issues confronting metal-mineral mines.

Seekers of import protection in Congress this year will add the international payments deficit to their reasons for cutting foreign trade. So, too, will opponents of foreign aid. The Kennedy Administration, however, will strongly adhere to liberal trade and aid policies (see highlights).

In the area of overseas private investment by U.S. firms, on the other hand, the dispute will be more touch-and-go between Congress and the Administration.

The new Government policymakers generally favor encouragement of U.S. private investment overseas on broad political as well as economic grounds. But Congressional drives, like Rep. Hale Boggs' (D-La.) last year to pass new tax benefits for overseas investors, face rougher sledding than ever.

Against the mounting opposition, however, is a rising argument by U.S. investors abroad that their ventures bring more dollars back to the U.S. in profits than they lose in direct outlays.

Commerce Department figures show, for example, that while U.S. private industries poured $11-billion into direct foreign investments over, roughly, the past 10 years, the direct profit return was $19-billion. Thus the investors can —and do—claim that their activities add to, rather than subtract from, the nation's balance of payments.

Aluminum Controls Urged

In a move to protect the domestic aluminum industry and the small non-integrated fabricators and processors and to halt the drain of an "essential raw material," the House Small Business subcommittee, headed by Sidney Yates (D.-Ill.), recommended (1) the use of "proper and necessary controls" of exports by the Commerce Department and (2) the continued investigation by the Justice Department and the FTC into the pricing of molten aluminum, the price squeeze between integrated producers and small non-integrated fabricators and processors, and mergers.

Labor This Month

MINE-MILL'S 1961 TROUBLES: The new year starts poorly for the International Union of Mine, Mill and Smelter Workers. Plagued for some time by rising unemployment and dropping membership, MMSW is hard hit by two year-end developments:

At Kellogg, Idaho, MMSW loses more than 1000 members in a wind-up of a six month strike at Bunker Hill Co. The strikers, in ending their long walkout, rejected Mine-Mill as their union and voted to join the Northwest Metal Workers Union—an independent. Via a National Labor Relations Board election, Bunker Hill employees voted 672 to 621 in favor of the local union. It was a double blow; the long walkout at the lead and zinc company had cut heavily into Mine-Mill's treasury.

Another 170 Mine-Mill members lose their jobs this year with the closing of the Leadville, Colo., operation of the American Smelting and Refining Co. The ASARCO shutdown is attributed to declining iron ore supplies. The smelter has been in operation since 1899.

LABOR-MANAGEMENT PEACE PROJECT: The Kennedy Administration's Secretary of Labor, Arthur J. Goldberg, has ambitious plans for ending the hostilities—at the bargaining table and elsewhere—between unions and employers. A union attorney prior to his appointment to the cabinet post, Goldberg has warned that a hostility has been building up for both sides. In his role as Labor Department chief, he is offering a formula to end the disharmony. The plan: To have President Kennedy appoint a labor-management advisory council which would tackle such tough subjects as automation and unemployment and would step in to help solve national emergency disputes. The council would be composed of officials of labor, management and government.

When Goldberg advanced this solution recently, he won support from a nonferrous industry official, Charles R. Cox, president of the Kennecott Copper Corp. Said Cox: "To me it has merit . . . and should be given serious consideration."

THE BARGAINING OUTLOOK—COSTLY: In the coming 12 months, wage negotiations, covering two million workers, will come to a head. But the settlement prospects are already in sight. The tip-off comes from the long-term contracts signed last year and earlier, which provide automatic increases from some 2.9-million employees this year. Even before the first 1961 settlement, the average pay hike figures out to 8¢-an-hour. This is the most frequently deferred pay increase. In metalwork, the deferred pay hike range is from 5 to 8¢, with nonferrous metals totalling 7.1¢-an-hour. Largest of the automatic pay hikes is in the construction industry—a tidy 14¢ hourly.

The deferred wage level will be a big influence on 1961 bargaining. But other major issues are likely to come to a head this year. The key talks to watch are these:

Major trucking contracts expire this month. James R. Hoffa, Teamster Union president, takes control of the union's western division negotiations for the first time and will seek a cross-country pattern to go with his settlements with eastern and central states truckers.

The shorter work week—labor's goal for the future—may get a nudge in the rubber industry bargaining with the United Rubber Workers, beginning in April. This union has already made a dent in trimming working hours.

Automation and how to save jobs of union members is probably the foremost issue in labor-management negotiations. The meat packing industry, with an automation pact already in the works with AFL-CIO unions, will discuss extending it in August bargaining.

Walter Reuther's United Auto Workers meet the major auto producers in 1961's most important talks. Here, the parties are likely to tangle over the cost-of-living escalator clause. Reuther will seek to retain it in the labor contracts; the auto makers hope to follow other industries in eliminating it from their labor agreements.

MARKETS

Lead, Zinc Prices Cut 1c to 11c, 12c; Copper Slow; Braden Strike Pending

THE E&MJ INDEX OF NONFERROUS metal prices dipped from 120.2% of the 1947-49 average in November to 118.7% in December, the lowest month of 1960. Declines of ½c in the price of zinc and .6c in lead during the month, along with a decrease in the price of lesser-weighted tin were responsible.

The over-all 1960 index was 124.8% of the 1947-49 average with high (127.8) recorded in January. The 1959 average, which climbed steadily from the close of the 1958 recession year, was 121.7.

E&MJ annual averages for 1959 and 1960 are listed below:

	1959	1960
Copper, dom., f.o.b. ref'y	31.182	32.053
Copper, foreign, f.o.b. ref'y	28.892	(c)29.894
Lead, common, N. Y.	12.211	11.948
Lead, common, St. Louis	12.013	11.748
Zinc, P. W., St. Louis	11.448	12.946
Tin, Straits, N. Y.	102.053	101.438
Silver, New York	91.202	91.375
Quicksilver (flask 76 lb)	$227.484	$210.760
Antimony dom., N. Y. (cases)	32.590	32.590
Antimony, dom., bulk, Laredo	29.000	29.000
Platinum, refined	$73.250	$81.729
Cadmium (lb sm. lots)	134.583	142.494
Aluminum, 99.5% ingot	24.738	26.000
Magnesium, ingot F.o.b.	35.250	35.250
Nickel, electrolytic	74.000	74.000
Sterling Exchange, U. S. cents per	280.870	280.758

U.S. copper producers and custom smelters maintained a 30c a lb delivered price throughout December, but there was little confidence in the price as the year ended. The problem was here in the domestic market where wary consumers continued to look at their inventories and lack of orders. The size of the recent slash from 33c to 30c and London's stability—which was widely termed technical—lent support to the price during the month. As long as U.S. copper is available at less than imported metal, many believe the price will hold. London had begun to slip as the year ended, as many had predicted, and was posted at £226¼ (28.3c) prompt bid on the first day of the month compared with a December average of about £231 (28.9c). Experts consider a spread of 3c a danger signal and indication of a possible price cut.

Dealer copper available at nearly 1c under the 30c price again pressured custom smelters. Immediately before the cut from 33c to 30c, dealers with ready supplies took considerable business from established sellers on the strength of bargain prices. Such a situation appears to be again gaining momentum.

U.S. stocks in November climbed 17,000 tons as production held up and shipments failed to reach September's level. Fabricator stocks moved off in November and sales improved, but orders for new copper continued to dwindle.

Kennecott's El Teniente Mine in Chile was scheduled to go out on strike at the beginning of the year, but at the last minute the walkout was postponed until Jan. 8. Workers have voted to strike, but had indicated they would be willing to accept an increase similar to the one granted Anaconda's Chuquicamata plant. The company's offer at this writing was considerably lower.

Zinc prices were cut a full cent during the month—½c on Dec. 13 and another ½c on December 19. The cuts were initiated by two different smelters. Zinc prices became vulnerable when N.J. Zinc settled its strike last month and returned 10,000 tpm production to an already oversupplied market. When Bunker Hill returned to work late in the month, bringing about 6,200 tpm of high grade material back to the market, the situation was further compounded. Statistics for the month were bolstered by improved export activity, but indicated a marked slump in U.S. demand. The new price of 12c a lb East St. Louis for Prime Western material was hoped to stimulate cutbacks as well as lure buyers. Smelters with prospects of supplies piling up were also desirous of taking in concentrates at lower prices. The price was vulnerable as the year ended. The market picture clouded in the early days of 1960 with announcement by one producer that it would offer discounts on average price sales.

Unlike the situation in zinc, the 1c cut in the price of lead came as a surprise to most market observers. The drop to 11c a lb N.Y. was effective December 13. The price is considered a low one—low enough to smoke out hesitant buyers and perhaps bring about some production curtailment. Sales reported to E&MJ on the week following the cut were very high, but as the month ended and activity had subsided, informants were of the opinion that the new price had made little difference. December sales were approximately 5,000 tons behind November at the September-October level. Higher stocks and lower shipments in November pressured the new price as the year closed.

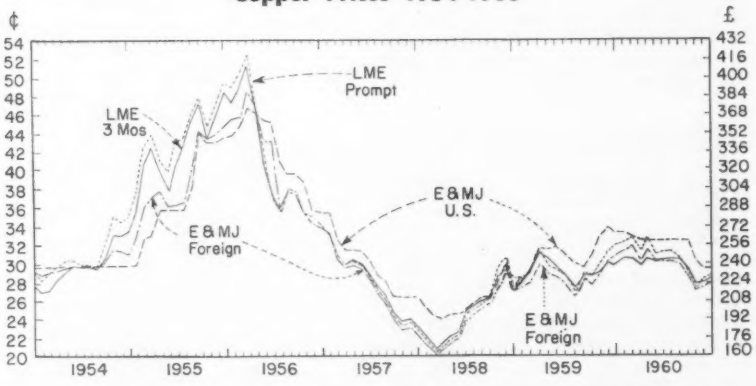
Primary aluminum stocks were at a record high at the end of September—226,000 tons. Shipments after some improvement in August dropped 18,000 tons to the level of early summer. November output was lower than any other month of the year but February and left the industry operating at 79.5% of capacity compared with 79.7% in October. The industry was expected to exceed 2-million tons output in 1960—a new record despite cutbacks.

The House Committee on Small Business has recommended regulation of scrap exports. Smelters claimed in a May hearing that integrated producers can keep scrap, which is their raw material, away from them by buying and exporting in the open market.

Activity in the N.Y. tin market continued slow this month, with the price falling 1¾c to 100.250c. This reflected London where the price declined £10.

The International Tin Council, meeting early in the month in Rome, decided to continue quota-free production through the first quarter of 1961. Japan announced that it would join the ITC, leaving the U.S. and West Germany as the only major Free World consumers not in the Agreement. Rumor is that West Germany will enter before long.

Copper Prices 1954-1960



Monthly averages. E&MJ weighted averages are computed from actual reports of sales to E&MJ—normally 140,000 to 17,000 tons per month. LME prices are the average of the mean of the bid and asked; they refer to long tons. The two scales are equal at an exchange rate of $2.80 per £. £320 is 40c a lb, etc. Data through December 1960.

Average Prices December (E&MJ Quotations)

Cents per lb unless otherwise indicated:

Copper:	
Electro, domestic refinery	29.600
Electrolytic, exports refinery	28.036
Electrolytic, c.i.f. Cont'l ports	28.981
Lead:	
Common, New York	11.381
Common, St. Louis	11.181
Silver:	
Silver, New York, per oz	91.375
Silver, London, pence per oz	79.463
Zinc:	
Prime, Western, East St. Louis	12.476
Prime, Western, delivered (g)	12.976
Tin:	
New York Straits	101.161
Gold, per oz, U.S. price	$35.000
Sterling, Exchange	280.737
Quicksilver, per flask	$209.000
Antimony, (E&MJ) (d)	32.590
Antimony, bulk, Laredo	29.000
Antimony, in cases, Laredo	29.500
Antimony for. 99% (h)	23.875
Palladium, troy oz	$24.000
Platinum, refined, per oz	82.000
Cadmium (a)	150.000
Cadmium (b)	160.000
Al, 99½% unalloyed ingot	26.000
export, ingot	23.250
Magnesium, ingot	35.250
Nickel, (f)	74.000
Bismuth	$2.250
Cobalt	$1.500

Domestic quotations, unless otherwise stated are in cents per lb. Sterling exchange checks, in cents. Quicksilver per flask of 76 lb.
(a) Per lb delivered, ton lots.
(b) Per lb delivered, small lots.
(d) Domestic 5 tons or more but less than carload lots, packed in case f.o.b. New York.
(f) Contract price, f.o.b. Port Colborne U.S. duty included.
(g) Delivered where freight exceeds 0.5c.
(h) 2c duty extra.

Free Gold Market

The volume of international gold dealings increased 122.7% in 1960, a record high. Total transactions came to $3.9-billion, against $1.7-billion at the end of 1959. Bar prices rose 4¼%, while coins averaged a 4¾% rise in 12 months. Highlights of the year were: Continued outflow of gold from the U.S., shrinking the stock from $19.507 to $17.-883-billion; private U.S. hoarding purchases, which rose during 1960 with the buying of nearly $4-million of the yellow metal; London gold prices hit a high of $41.50 per oz in October; Soviet gold sales declined as only $150-million were shipped to Western markets. Pick's World Currency Report quotes on "free gold" per fine oz as follows:

	Coins		Bars (12.5 kg)	
	Nov. 30	Dec. 31	Nov. 30	Dec. 31
New York transit	.....	.....	$35.75	$35.60
Manila	$41.60	$41.65	37.00	37.10
Hong Kong	48.85	48.70	41.12½	41.00
Bombay	54.00	54.25	51.00	51.50
Beirut	41.05	41.35	35.90	35.78
Paris	41.35	41.70	36.15	36.25
Buenos Aires	41.60	42.15	37.40	37.50

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Custom Smelter Copper

Based on flat price and E&MJ average price sales in U.S. for month of December reported by American Smelting & Refining Co. electrolytic copper in standard shapes, adjusted to nearest ⅛c; ¼c deducted for selling common.

Delivered consumer's plant . . 29.750 lb
F. o. b. refinery . . . . . 29.350 lb

Major Metals

U.S. DAILY AND AVERAGE PRICES

Cents per lb unless otherwise indicated:

Dec. 1960	Electrolytic Copper (a) Domestic	(b) Export	Europe c.i.f. (e)	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Ingot 99% U. S. Dest.	Straits Tin New York
1	29.600	28.150	29.095	12.000	11.800	13.500	13.000	26.000	102.000
2	29.600	28.150	29.095	12.000	11.800	13.500	13.000	26.000	102.000
5	29.600	28.225	29.170	12.000	11.800	13.500	13.000	26.000	102.125
6	29.600	28.250	29.195	12.000	11.800	13.500	13.000	26.000	102.000
7	29.600	28.450	29.395	12.000	11.800	13.500	13.000	26.000	101.875
8	29.600	28.350	29.295	12.000	11.800	13.500	13.000	26.000	101.750
9	29.600	28.425	29.370	12.000	11.800	13.500	13.000	26.000	101.500
12	29.600	28.375	29.320	12.000	11.800	13.500	13.000	26.000	101.375
13	29.600	28.350	29.295	11.000	10.800	13.000	12.500	26.000	101.375
14	29.600	28.150	29.095	11.000	10.800	13.000	12.500	26.000	101.375
15	29.600	28.025	28.970	11.000	10.800	13.000	12.500	26.000	101.125
16	29.600	27.950	28.895	11.000	10.800	13.000	12.500	26.000	101.000
19	29.600	27.700	28.645	11.000	10.800	12.500	12.000	26.000	100.875
20	29.600	27.500	28.445	11.000	10.800	12.500	12.000	26.000	100.875
21	29.600	27.550	28.495	11.000	10.800	12.500	12.000	26.000	100.625
22	29.600	27.875	28.820	11.000	10.800	12.500	12.000	26.000	100.625
23	29.600	28.025	28.970	11.000	10.800	12.500	12.000	26.000	100.500
26				Holiday					
27	29.600	27.950	28.895	11.000	10.800	12.500	12.000	26.000	100.500
28	29.600	27.900	28.845	11.000	10.800	12.500	12.000	26.000	100.375
29	29.600	27.700	28.645	11.000	10.800	12.500	12.000	26.000	100.250
30	29.600	27.700	28.645	11.000	10.800	12.500	12.000	26.000	100.250
AVERAGES FOR MONTH									
Dec.	29.600	28.036	28.981	11.381	11.181	12.976	12.476	26.000	101.161
AVERAGES FOR WEEK									
Dec. 7	29.600	28.245	29.190	12.000	11.800	13.500	13.000	26.000	102.000
14	29.600	28.330	29.275	11.600	11.400	13.300	12.800	26.000	101.475
21	29.600	27.745	28.690	11.000	10.800	12.700	12.200	26.000	100.900
28	29.600	27.938	28.883	11.000	10.800	12.500	12.000	26.000	100.500
CALENDAR WEEK AVERAGES									
Dec. 2	29.600	28.075	29.020	12.000	11.800	13.500	13.000	26.000	102.050
9	29.600	28.340	29.285	12.000	11.800	13.500	13.000	26.000	101.850
16	29.600	28.170	29.115	11.200	11.000	13.100	12.600	26.000	101.250
23	29.600	27.730	28.675	11.000	10.800	12.500	12.000	26.000	100.700
30	29.600	27.813	28.758	11.000	10.800	12.500	12.000	26.000	100.344

THE above quotations for major nonferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered U.S. basis add 0.400c per pound, the average differential for delivery charges.

(b) Export copper daily quotations are weighted averages based on sales outside the U.S. reported to E&MJ. Ocean freight and 0.125c lighterage and handling are deducted to arrive at the f.o.b. Atlantic seaboard refinery quotation. On f.a.s. U.S. sales lighterage of 0.125c is deducted.

(e) The c.i.f. Continental ports quotation is arrived at by adding to the f.o.b. export quotation lighterage, and the standard conference freight and insurance, Atlantic ports to main Continental ports. Currently this is 0.125c and 0.82c.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West and West effective Apr. 1, 1960, commanded a premium of 1.50c per pound over the current market for Prime Western; Special High Grade 1.75c effective Apr. 1, 1960.

(f) Prime Western delivered where freight from E. St. Louis exceeds 0.500c.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points (almost all U. S. lead is corroding grade).

(c) The daily silver quotations reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harmon in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually 0.250c below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5c per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price is $35. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Dec. 1960	Silver (c) New York	Silver London	Sterling Exchange	Gold (p) London
1	91.375	79.500d.	281.0420	252s. 9d.
2	91.375	79.500d.	281.0460	252s. 0d.
5	91.375	79.500d.	281.0340	252s. 1d.
6	91.375	79.500d.	280.9040	252s. 6d.
7	91.375	79.500d.	280.9640	252s. 10d.
8	91.375	79.500d.	280.9380	252s. 7d.
9	91.375	79.500d.	280.8600	252s. 9d.
12	91.375	79.500d.	280.6780	253s. 6d.
13	91.375	79.500d.	280.6780	254s. 0d.
14	91.375	79.500d.	280.7460	253s. 8d.
15	91.375	79.500d.	280.8160	253s. 3d.
16	91.375	79.500d.	280.7040	253s. 0d.
19	91.375	79.500d.	280.6400	253s. 1d.
20	91.375	79.500d.	280.7820	253s. 1d.
21	91.375	79.375d.	280.7900	253s. 0d.
22	91.375	79.375d.	280.6100	253s. 2d.
23	91.375	79.375d.	280.5180	253s. 6d.
26		Holiday		
27	91.375	Holiday	280.5800	Holiday
28	91.375	79.375d.	280.4200	253s. 10d.
29	91.375	79.375d.	280.3860	254s. 1d.
30	91.375	79.375d.	280.3400	254s. 0d.
AVERAGES FOR MONTH				
Dec.	91.375	79.463d.	280.737	—
AVERAGES FOR WEEK				
Dec. 7	91.375	—	280.998	—
14	91.375	—	280.780	—
21	91.375	—	280.746	—
28	91.375	—	280.532	—

Calendar Week Averages: New York Silver: Dec. 2, 91.375; Dec. 9, 91.375; Dec. 16, 91.375; Dec. 23, 91.375; Dec. 30, 91.375.

MARKETS (*Continued*)

London Metal Exchange Quotations

Dec. 1960	Copper Cash Bid	Copper Cash Asked	Copper 3 Mon. Bid	Copper 3 Mon. Asked	Lead Current Month Bid	Lead Current Month Asked	Lead 3 Mon. Bid	Lead 3 Mon. Asked	Zinc Current Month Bid	Zinc Current Month Asked	Zinc 3 Mon. Bid	Zinc 3 Mon. Asked	Tin Cash Bid	Tin Cash Asked	Tin 3 Mon. Bid	Tin 3 Mon. Asked
1	231⅜	232	228½	228¾	66⅝	66¾	67⅛	68	86	86¼	85⅛	85⅝	799½	800	797½	798½
2	232½	232¾	229¼	229½	66½	66⅝	67⅜	67⅝	86¼	86⅜	85⅛	85⅜	799	799½	797	797½
5	233⅜	234	230½	230½	66¼	66½	67½	67⅝	86½	86⅜	85⅛	85⅜	799	800	797½	798
6	234⅜	235¼	231⅛	231½	66⅜	66½	67⅝	67⅞	86⅛	86⅜	85⅞	86⅛	798½	799	796½	797
7	234¼	234½	230¾	231	66¼	66½	67½	67¾	86½	86¾	86⅛	86¼	798	798½	795½	796
8	234½	234⅝	231¼	231⅜	66	66⅛	67⅛	67½	86¾	87	86	86⅛	798	798½	795⅛	796
9	233½	233¾	230¼	230½	65⅝	65⅝	66⅞	67	85⅜	86⅛	85⅛	85½	797	797½	794½	795
12	234¼	234½	230¾	231	65⅝	65¾	66⅛	66¾	84½	84⅝	84⅛	84½	796	796½	794½	795
13	234	234¼	230¼	230½	65⅜	66	66⅜	67	83⅜	83⅞	83⅞	84	797	797½	795	795½
14	230½	230¾	227⅝	228	65¼	65⅝	66½	66¾	82½	82⅝	82¾	82⅞	797	797½	795½	796
15	229¼	229½	226¼	226½	64⅞	65	66¼	66⅝	81¾	82	82	82¼	798½	799	796	796½
16	228¾	229	225¾	226	65⅛	65¾	66½	66⅞	82	82½	82¼	82½	797½	798	795	795½
19	226½	226¾	224½	224¾	63¾	64	64⅞	65	80½	80⅝	80⅞	81	796	796½	793½	794
20	226	226¼	224¼	224½	63¼	63⅝	64¼	64½	80¾	80⅞	80¼	80⅝	794½	795	792	792½
21	228¼	228½	226¼	226½	64	64¼	65¼	65½	80½	80⅝	80¾	81	792½	793	791	791½
22	230¼	230½	227¾	228	64¼	64⅜	65½	65⅝	80¾	81	81	81¼	792½	793	790½	791
23	230¾	231	228¼	228½	64¼	64⅜	65⅜	65½	79¾	80	80½	80¾	790	791	790	790½
26	Holiday															
27	Holiday															
28	228¼	228½	226	226½	63¾	64	64⅜	65	78	78¼	78¾	78⅞	789	789½	788½	789
29	227¼	227½	225¼	225½	61¾	62	63¾	63½	76½	76¾	77	77¼	786½	787	785½	786
30	228	228¼	226¼	226½	62	62¼	63¾	64	78¼	78½	79	79¼	787½	788	787½	788
Av'g's	£230.981		£228.169		£64.975		£66.194		£82.763		£82.747		£795.450		£793.688	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.0%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments, f.o.b. New York unless otherwise stated, tons of 2,000 lb unless otherwise noted. st—short ton; lt—long ton; stu—short ton unit; ltu—long ton unit. (p) duty extra.

MISCELLANEOUS METALS

Dec. 31, 1960

Aluminum ingot, 99.9% lb		28c
Antimony, spot, lb, less than carload, in cases		32.59c
In bulk, carload lots, f.o.b. Laredo		29.00c
Imported, 10 ton min. (p), 99% Duty not paid	23¾ —	24c
Bismuth, ton lots, lb		$2.25
Cadmium, ton lots delivered, lb		$1.50
small lots		$1.60
Calcium, lb, ton lots, 98%, cast		$2.05
Chromium, 99.8% grade, lb, contract delivered	$1.15 —	$1.19
Cobalt, 97 to 99%, per lb effective 3-1-60		$1.50
Germanium, per gram, 10,000 gram lots	(d)28.15c—(c)(d)	29.95c
Indium, troy oz	$1.35 —	$2.25
Lithium, lb, 98%	$9.00 —	$11.00
Nickel, cathodes, lb (a)		74c
Other sales, regular sellers		74c
Sales by dealers, etc		74c
Magnesium, 99.8% carloads, lb producer's plants, Velasco, Texas, effective Apr. 16		35¼
Palladium, troy oz	$24 —	$26
Platinum, troy oz	$81 —	$85
Quicksilver, flask of 76 lb, 25 flasks or more	$209 —	$212
Selenium, 99 plus %, lb—(Feb. 19, 1958)	$6.50 —	$7
Silicon, minimum 98%, carloads, lb		19c
Semi Conductor grade, lb		$360
Tellurium, lb		$4.00
Thallium, 100 lb or more		$7.50
Titanium, 99.3% plus, grade A-1, max. 3% Fe, lb (b)	$1.50 —	$1.60

(a) Effective Dec. 6, 1956; including U. S. duty; (b) Effective Aug. 1, 1959. (c) Delivered; (d) f.o.b. plant.

METALLIC ORES

Beryllium ore, imported, 10% BeO, (b) stu; spot	$31.75 —	$32.50
term contracts	$34 —	$34.50
Chrome ore per long ton, f.o.b. cars Atlantic ports, dry:		
44% Cr_2O_3 no ratio	(a)$19.75 —	$20.50
48% Cr_2O_3 3 to 1 ratio	$35¼ —	$38
Iron ore, Lake Superior, Lower Lake ports, lt		
Old Range bessemer		$11.70(e)
Mesabi bessemer		$11.60(e)
Mesabi non bessemer		$11.45(e)
Lead (Galena), 80% Joplin, Mo., ton		$125.16

Manganese ore—Per ltu of Mn basis 48%, nearby positions, subject to premiums and penalties, c.i.f. U. S. ports import duty extra., (n)87c—90c. Long-term contract nominal.

Molybdenum ore, 90%, per lb of Mo f.o.b. mines		$1.25
Columbium-Tantalum, per lb, combined oxides 10 to 1 ratio	$1.18 —	$1.25
Tungsten ore, per stu of WO_3:		
Foreign 60%, c.i.f. U. S. ports, duty extra	$18.50 —	$19.00
U. S. scheelite, f.o.b. mill	$22 —	$24
Vanadium ore, per lb of contained V_2O_5 f.o.b. mines		31c
Zinc ore, Prime, 60% concentrate, Joplin, Mo., per ton		$72

(a) Nominal. (b) c.i.f. U. S. ports. (e) Effective 1958 shipping season.

METALLIC COMPOUNDS

Arsenous oxide (arsenic trioxide) lb, in bbl, carload lots N. Y. docks		4-5c
Cobalt oxide, 72½% to 73½%, per lb, effective Mar. 1, 1960	$1.15 —	$1.18
Copper sulphate, 100 lb, effective 10-12-60		$12.25
Germanium dioxide, gm		16¾c
Molybdic trioxide, technical, per lb of Mo	$1.46 —	$1.47
Imported, including 37c duty	$1.75 —	$2.05

ALLOYS

Ferrochrome 65 to 70%, per lb of Cr, (4-9% C)		28¾c
Ferromanganese, 74 to 76%, per lb shipping point		11c
Ferromolybdenum, 58 to 64% Mo, lb of Mo contained	$1.50 —	$1.82
Ferrosilicon, 50% per lb of Si f.o.b. shipping point (3-1957)		14.60c
Ferrotungsten, 72 to 82%, lb of W contained		$2.15
Ferrovanadium, per lb of V delivered	$3.20 —	$3.40
Silicomanganese, max., 1½% C, lb contracts		11.6c
Spiegeleisen, per lt, 19–21% grade effective Jan 22	$100.00—	$102.50

NONMETALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (Canadian funds) ton:			
Crude No. 1	$1,400–$1,725	Paper stock	$120–$142
Crude No. 2	$750–$1,100	Waste	$75– $86
Spinning Fibers	$370– $600	Shorts	$40– $75
Shingle fibers	$180– $220		
Asbestos, f.o.b., Vancouver, B. C. (Canadian funds):			
Crude No. 1	$1,522	Spinning fibers	$220–$787
Asbestos, Vermont, f.o.b. Morrisville:			
Spinning fibers	$353– $408	Waste, stucco or plaster	$86
Shingle stock	$181– $218	Refuse or shorts	$41– $75
Paper stock	$120– $142		

Barytes, f.o.b. cars:		
Georgia, crude, per ton		$18
Missouri, 94%, $BaSO_4$, per st	$16 —	$18
Crude oil well grade, min. 4.3 sp gr, st (a)		$18
Imported, c.i.f. Gulf Ports, st	$16 —	$18
Bauxite, st, f.o.b. point of shipment:		
Imported metallurgical, per lt, f.o.b. Br. Guiana, 60% Al_2O_3, 6% SiO_2, 1.25% Fe, 1-1-60		$7.25
Feldspar, bulk ton; f.o.b. plants:		
Potash or soda feldspar, 200 mesh, ceramic grade	$17 —	$20.50
Glass feldspar, white, 20 mesh		$9
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37 —	$41
60% effective CaF_2	$33 —	$36
Acid 97% concentrate, bulk, ton		$45.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 —	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington		$46

Mica—Domestic, f.o.b. mines, Punch 7c-12c per lb according to size and quality. Sheet clear 1½x2 in. 70c-$1.10; 2x2 in $1.10 to $1.60; 2x3 in, $1.60-$2.10; 3x3 in, $1.80-$2.30; 3x4 in, $2.00-$2.60; 3x5 in, $2.60-$3.00; 4x6 in, $2.75-$4.00; 6x8 in, $4.00-$8.00. Wet ground, very fine, $140-$155 per ton. Bulk sales, dry ground; $30-$55 per ton. Scrap $20-$30.

Ocher, Georgia, ton in sacks	$26.50 —	$32.00
Sulphur, Mexican, for use in Mexico, metric ton, f.o.b. mines, depending on location	$21 —	$23
For export f.o.b. vessel, depending on grade	$22.50 —	$23.50

Actual prices received by U. S. producers approximate the Mexican export prices.

Talc, f.o.b. works, ton:		
New York, purified	$18.00 —	$20.00
Vermont, extra fine		$12.50
Tripoli, Missouri, ton:		
40-mesh, cream colored		$50.00

(a) Some restricted sales at $11.50, (b) Corrected. (c) Nominal.

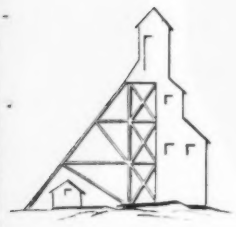
IRON AND STEEL

Pig iron, gross ton, basic, Valley furnaces		$66.00
Steel, f.o.b. Pittsburgh, billets, net ton		$80.00
Structural shapes, Pa., Ala., etc., 100 lb	$5.30 —	$5.50

CYANAMID

Reagent News

"ore-dressing ideas you can use"



Synergism Down Under*

SODIUM AEROFLOAT® Promoter-Xanthate Combination Increases Copper Recovery at Lake George Mines, New South Wales

Realizing that better metallurgy could come only from more ingenious use of reagents, this well established property centered its laboratory and plant experimental work on new reagent combinations and thereby made very worthwhile gains in recovery.

Lake George Mines has for many years treated upwards of 500 tpd of intimately mixed sulphides in a 40% schistose gangue. Feed from several separate orebodies averages 5.5% Pb; 9.5% Zn; 0.6% Cu; 1.0 dwt Au/ton; 1.3 oz. Ag/ton and 15% Fe. Feed is ground to 77% minus 325 mesh to recover galena, sphalerite, chalcopyrite and iron pyrites in separate concentrates. Copper is floated ahead of lead using starvation quantities of reagent, depressing zinc with SO_2.

SODIUM AEROFLOAT—sodium ethyl xanthate combination was used with good results until import restrictions necessitated replacement of SODIUM AEROFLOAT by xanthate alone from June 1958 to May 1959. Recovery and grade of copper concentrates fell off markedly during this time. Testing done during this period indicated that a combination of SODIUM AEROFLOAT and ethyl xanthate would produce higher recovery than either reagent alone and the combined reagent schedule was adopted again in June 1959. Mill results for two twelve-month periods showed:

	June '58-May '59 Xanthate only	June '59-May '60 SODIUM AEROFLOAT Plus Xanthate
Cu Conc. Grade	17.4%	19.2%
Cu Recovery	74.8%	77.2%

Copper is floated at pH 7 with cresylic acid as frother (0.06 lb/ton) and sulphur dioxide (equal to 1.25 lb. sulphur/ton) to depress zinc. When the promoter was sodium ethyl xanthate alone 0.15 lb. per ton was added. This has been changed to 0.08 lb. of xanthate per ton and 0.04 lb. of SODIUM AEROFLOAT per ton.

Cyanamid field engineers will be glad to work with you to evolve the reagent combination that will produce highest recovery at the lowest cost-plus-tails. Having a complete line of metallurgical reagents, Cyanamid offers unbiased counsel in their most effective use as well as prompt, unfailing delivery to every mining field.

***Synergism—the cooperative action of two discrete agencies such that the total effect is greater than the sum of the two effects taken independently.**

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London W.C. 2, England

SOUTH AFRICAN CYANAMID (PTY.) LTD.
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YANAMID INTER-AMERICAN CORPORATION
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Casilla 4393, Avenida Tacna 411
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Electric Blasting Caps
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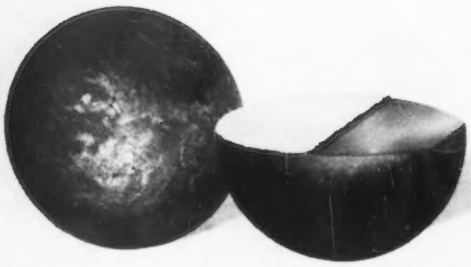
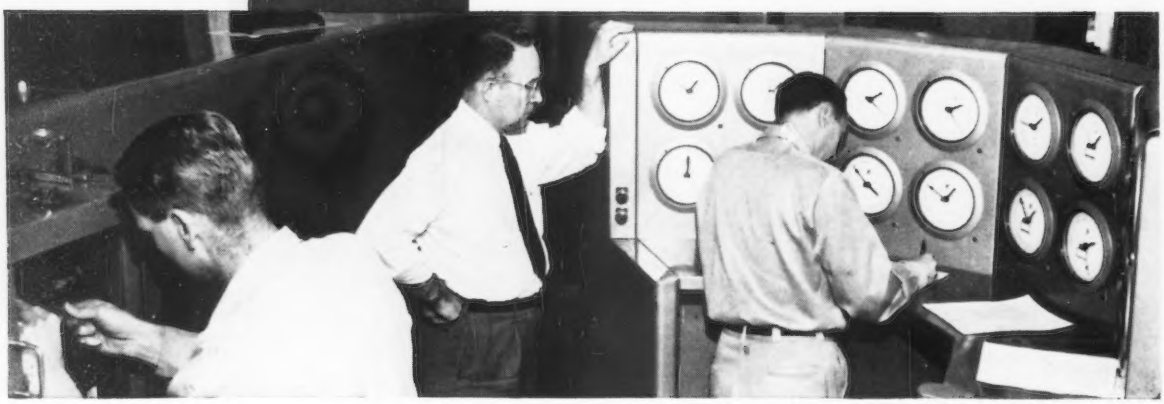
AMERICAN CYANAMID COMPANY
EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

CYANAMID INTERNATIONAL — *Mining Chemicals Department*
Cable Address: — Cyanamid, New York

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

New steels are born at Armco





consistently

U N I F O R M

quality control

SHEFFIELD
ARMCO
MOLY-COP
COPPER-MOLYBDENUM-ALLOY
Grinding Balls

Moly-Cop Balls are Sheffield-made from furnace to finished ball. Statistical quality controls are on the job at every step of production. That's why you can count on consistently high performance, long wear and greater grinding economy with Moly-Cop Balls. Why settle for anything less?

The Standard of Comparison Around the World

SHEFFIELD DIVISION

Sheffield Plants in Kansas City, Tulsa and Houston

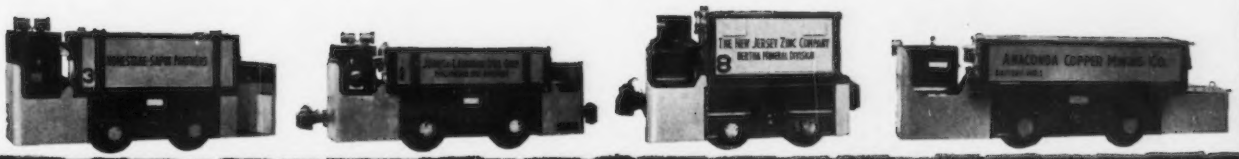
ARMCO STEEL CORPORATION

OTHER DIVISIONS AND SUBSIDIARIES: Armco Division • The National Supply Company • Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Union Wire Rope Corporation • Southwest Steel Products

National Mine Service Company

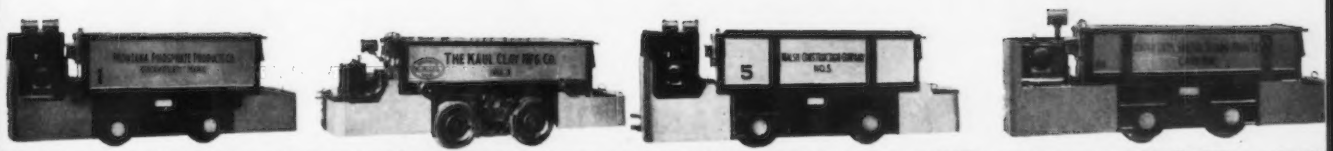
GREENSBURG MINE LOCOMOTIVES

SERVING THE MINING INDUSTRY EVERYWHERE—
THE GREENSBURG DIVISION

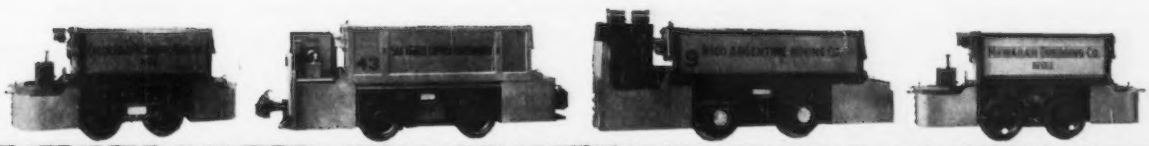


MANUFACTURING, SELLING AND SERVICING

THE FAMOUS GREENSBURG LOCOMOTIVES



GREENSBURG MONITOR—a great name in mine locomotives—is now an integral division of NATIONAL MINE. The complete range of Greensburg Monitor Storage Battery Locomotives, from 2 to 15 tons, is backed by the service of National Mine in every major mining area. When you want *more pulling power per ton*, with longer battery life and higher efficiency for every invested dollar, check the facts with National Mine!



National Mine Service Company

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Madisonville, Ky.

WHITEMAN DIVISION
Indiana, Pa.

How far will a Yieldable Set yield?

In any discussion of the Yieldable Arch or Ring, the question is invariably asked: How far will the Arch yield? Answer: It is not unusual to have a Yieldable Arch set yield until the legs almost touch each other at the center.

Gives Ground Chance to Settle

That's the whole point of the Yieldable Arch; it is *normal* for the joints to yield. It's the old technique of letting the enemy beat himself. By gradually "giving" under excessive pressures, the Arch gives the overburden a chance to settle into a natural arch of its own, and thus bring forces into equilibrium. As soon as stability is reached, the Yieldable Arch holds the line. A set of Arches consists of curved, U-shaped sections nested together and overlapped enough to permit clamping with two U-bolt clamps at each joint. The clamps control the degree of tightness, and permit yielding when the forces exceed the load for which the joint was intended. Each Yieldable Arch set is tied to adjoining sets by means of horizontal struts, which add lateral rigidity to the structure.

Usually Pays for Itself in a Year

Besides increasing mine safety, the Yieldable Arch offers high salvageability, and usually pays for itself within its first year of service. A Bethlehem engineer would like to discuss the application of the Arch to your roof problems.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

LUBE LOGIC

Winter maintenance tips

Now's the time for battery check-ups

With cold weather your batteries will be working harder than ever. Here's how you can help make sure they're up to it.

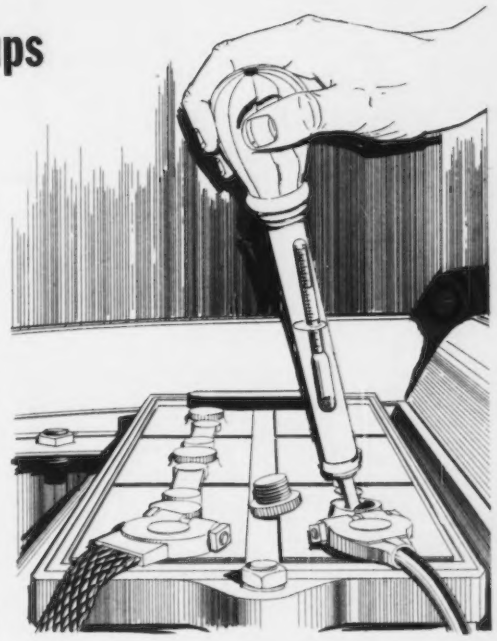
Inspection

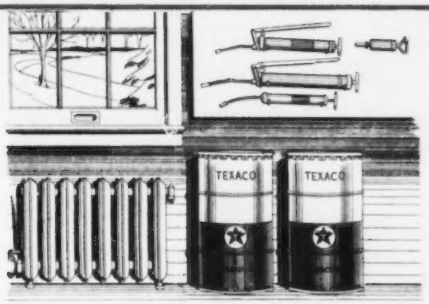
- Inspect battery case for cracks and leaks. See that vents in cell caps are open.
- Check battery posts and cable clamps for looseness, breakage or corrosion.
- Using distilled water, bring electrolyte in each cell up to level indicated in cell fill opening.

Hydrometer test for specific gravity

- Use a temperature-corrected hydrometer to test the state of battery charge. Make sure battery has not been recently fast-charged, nor water added.
- Draw enough fluid from each cell to raise float off bottom of hydrometer tube. Holding hydrometer straight up-and-down, take eye-level reading of the neck of the float. Repeat for each cell.
- Note the temperature, and correct hydrometer reading by subtracting 0.004 from the reading for each 10°F below 80°F. (Example: if hydrometer reads 1.280, and temperature is 70°F, correct the reading by subtracting 0.004 from 1.280. The correct reading is 1.276.

Normal state of charge for 12-volt battery is 1.260 to 1.280 specific gravity. For a 6-volt battery, normal charge is between 1.265 and 1.290 specific gravity.

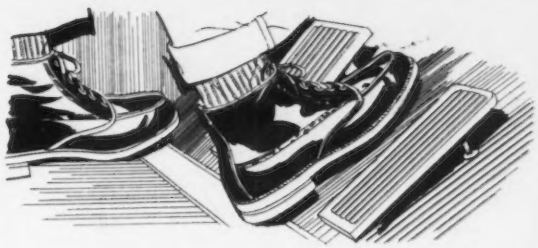




Grease guns like it warm

Not too hot—just nicely warm. Store grease guns this way, properly racked to avoid damage, and they'll give you much better service. Incidentally, lubricants like to be stored warm, too.

Warm up the guns if they're too cold to pump the lubricant. Best way is to bring them into a warm place far enough in advance of use. Don't ever attempt to warm them up by direct application of heat.



'Easy does it' after an oil change

When an engine's crankcase is drained, so is the oil pump's intake screen and pipe. And when the engine starts up after the change, the oil pump must first suck up a lot of thin, squashy air before it starts chewing oil. To avoid possible damage to the engine, idle it at first at low speed. The oil pressure should begin picking up in a matter of seconds and reach normal reading within several minutes. Wait until it does—before you start working the engine.

TEXACO LUBRICATION ENGINEERS

From time to time we'll bring you "sleepers" like these, little angles that can mean big savings in time and money. But for any specific lubrication problem, call on your local Texaco man. He's your best source of money-saving lubrication ideas. Remember, "lubrication is a major factor in cost control." Texaco Inc., 135 East 42nd Street, New York 17, N.Y.

TUNE IN: TEXACO HUNTLEY-BRINKLEY REPORT, MON. THROUGH FRI.—NBC-TV

TEXACO

TEXACO

Throughout the United States

Canada • Latin America • West Africa

LW **Haulpak® proves itself again...**

Comparative figures show 18.2% extra production

PERFORMANCE REPORT

CONDITIONS: Hauling top soil, subsoil, and clay loam overburden an average distance of 7,100 feet with an average 1.3% adverse grade. Maximum adverse grade was 400 feet of 5%.

MACHINES: LeTourneau-Westinghouse 32-ton Haulpaks and 22-ton trucks of another make. Loaded by a 4½-yd shovel.

PRODUCTION COMPARISONS: (16 loads weighed and timed.) Haulpaks averaged 30.9 tons per load, or 96.5% of rated capacity . . . to 19.05 tons or 87% of capacity of other trucks. Haulpak completed cycles in an average of 8.58 minutes compared to 9.5 minutes for the other trucks. Haulpak's speed and faster haul time is especially impressive when you consider LW load time of 1.26 minutes, to .96 minutes for the smaller-capacity truck. Production per 50-minute hour, per truck: Haulpak, 179 tons . . . other truck, 101 tons.

Hourly production for two 32-ton Haulpaks (two operators) . . . 358 tons. For three 22-ton trucks (three operators) . . . 303 tons.

COST AND PRODUCTION COMPARISONS: Although two of these Haulpaks sell for only 1.4% more than three of the smaller trucks, difference in production is amazingly high.

. . . 18.2% ABOVE THAT OF OTHER TRUCKS!

This detailed performance report is the result of studies made at a large cement plant quarry. Impressive conclusion? You bet it is! In fact, no other truck in the industry can compare with the production ability of the LeTourneau-Westinghouse Haulpak.

The reason is simply this: Haulpak is made up with a group of *proven* components (see opposite page), put together in a way that no one else has been able to do. It was built from the ground up *as an off-road hauler;* it is not just a beefed-up highway truck. *Everything* you see in the LW Haulpak truck has been carefully engineered with one objective: *To give you a NEW low-cost-per-ton-mile on your off-road hauling!*

Haulpak dumps another load at waste area. Twin three-stage hydraulic hoists raise body a full 70°, give complete load-ejection in just 16 seconds. Hoist-rams are inverted to shed dirt.

FLASH! Just as this report was ready for printing, owner of the Haulpaks used in this production study purchased 3 *additional LW Model 32 Haulpaks.* That makes a total of 6 in their fleet . . . further proof of satisfied performance!

Here are some of Haulpak's cost-cutting advantages:

"Bonus-tonnage" V-body: carries about 6 tons of material *below* normal floor line, provides low center of gravity . . . *Hydrair® suspension:* air-hydraulic suspension system cushions load and road shocks, eliminates springs, front-axle, and their related maintenance . . . *Power-Transfer Differential:* automatically transfers power to drive-wheel on best footing . . . *Short turn circle:* turns in ⅓ less space than comparable-capacity haulers, and *much shorter* than many smaller rigs — greatly reduces maneuvering and cycle time . . . *"Power-Miser" fan:* cools engine with 20 to 25 *less* hp-drain than conventional fans. Thermostat shuts off fan when not needed, saves its 10 hp for extra work power . . . *Biggest Brakes in the Industry:* up to 5,148 sq inches of total braking surface. Torqmatic brake, standard.

Let us show you more proof of LW Haulpak's cost-cutting abilities. We will also arrange a demonstration so you can *see* these trucks in action. Five sizes, 22 to 60 tons . . . up to 550 hp. Ask for complete details.

HP-2350-MQJ-2

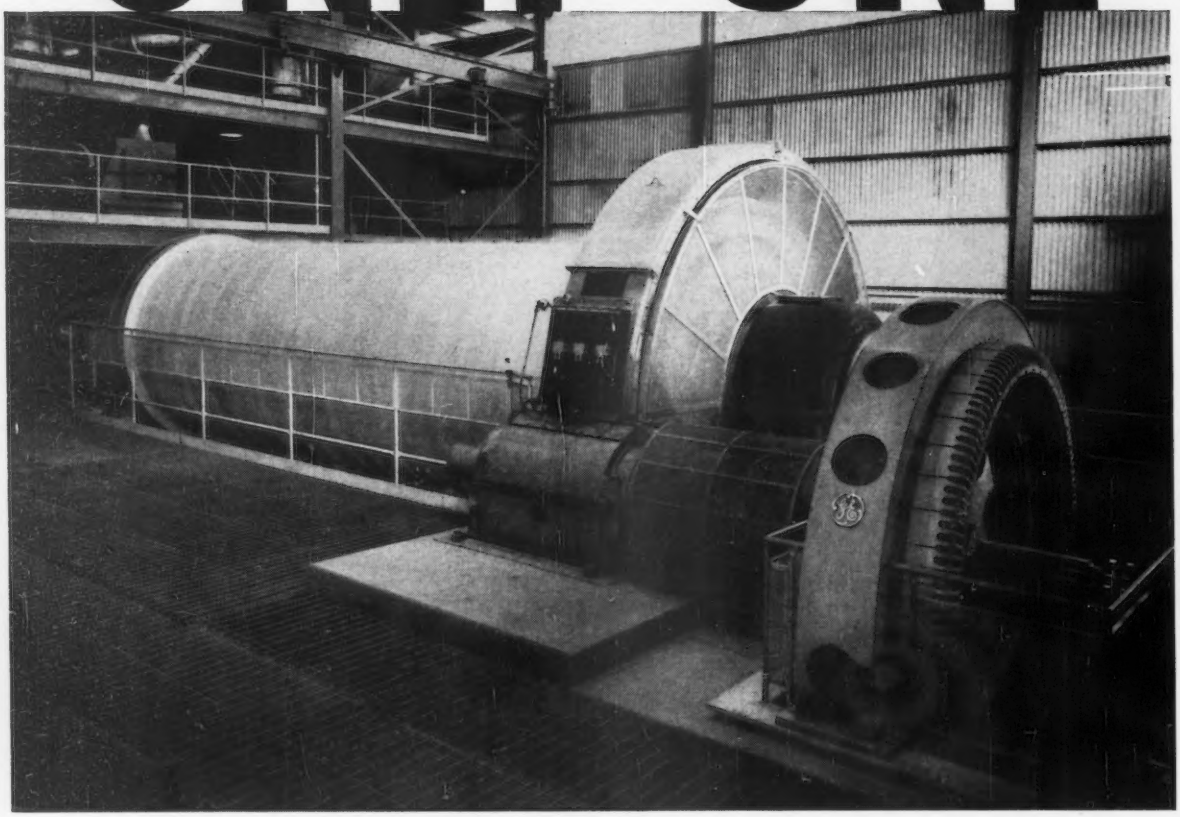
LW — LeTOURNEAU-WESTINGHOUSE

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

ONLY ONE



ONLY ONE TYPE AND SIZE FINISHING MILL WILL DO THE BEST JOB IN YOUR PLANT. THAT'S THE MILL TRAYLOR WILL BUILD FOR YOU

From requirements outlined by Standard Lime and Cement Company, Traylor engineers built this 10′ x 32′ two compartment ball mill for installation at Martinsburg, West Virginia. Write today and tell us the size product and capacity needed for a grinding mill in your plant. Our engineers, expert in this field, will recommend the mill Traylor-made specifically to fill your requirements most efficiently . . . most economically.

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for rock or ore

NEW 66"

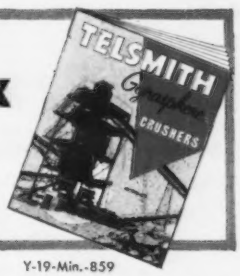
TELSMITH® Gyrasphere®

New 66" Telsmith FC Fine Crushing Gyrasphere with grooved pulley suitable for V-rope drive and with oil tank, oil piping and separate oil pump and motor are standard equipment on the new 66" Gyrasphere.

● The new No. 66 Gyrasphere combines all the big production, low-cost operation and maintenance features of other Telsmith Gyraspheres—plus new, simple and easy, hydraulic adjustment of discharge opening. Our new Bulletin No. 274 explains all of the outstanding features of the new No. 66 and gives complete information, including new capacity tables, on all sizes of Telsmith Gyraspheres. These are the Secondary Crushers which will give you *the lowest cost per ton.*

TELSMITH GYRASPHERES
NOW made in FOUR SIZES—
24", 36", 48", and the NEW 66"
. . . for Coarse and Fine Crushing

Get this NEW BOOK
it's your guide to more profit
Ask for No. 274



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SCRUBBERS

GIVE YOU JET-ACTION GAS-CLEANING WITH NO MOVING PARTS!

The Turbulaire-Doyle Scrubber is unique in its high collection efficiencies and low maintenance requirements because it incorporates a jet-action design that assures a far more thorough scrubbing action—yet requires no complex mechanical systems that boost maintenance and repair costs.

THE JET-CONE MAKES THE DIFFERENCE!

This Jet-Cone in the throat of each Turbulaire-Doyle inlet tube causes a sharp increase in the velocity of the incoming gases—the velocity reaching maximum at the point where the dirt-laden gases impinge upon the scrubbing liquid.

RESULT: ***unusually deep penetration of gases into the scrubbing fluid for more complete cleansing of all suspended particles—even those in the fume range.***

Yet there are no moving parts—nothing to require frequent repair or replacement!

ILLUSTRATED ABOVE: **Two-stage rubber-covered units remove dust and fume from gases at wet process phosphoric acid plant. Capacity: 64,000 CFM.**

Compare
TURBULAIRE-DOYLE ADVANTAGES

- **HIGH COLLECTION EFFICIENCIES** generally in the 97% to 99% range.
- **FINE PARTICLE COLLECTION** even fume-range particles.
- **LOW LIQUID-TO-GAS RATIO** only 1 to 5 GPM/1000 CFM.
- **NEGLIGIBLE MAINTENANCE** no moving parts to wear or corrode—no "plugging" problems.
- **NO CORROSION PROBLEMS** simple design permits wide choice of corrosion-resisting materials.

Send for Descriptive Bulletin!

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Cottrell Precipitators	Multiclone Dust Collectors	Therm-O-Flex Hi-Temp Filters	Dualaire Reverse-Jet Filters	Turbulaire-Doyle Scrubbers	Joy Microdyne Scrubbers	Combination Units	Holo-Flite Processors	Hi-Turbiant Heaters

Learning is a two-way street

Working with drill operators to achieve top performance from Gardner-Denver rock drills is all in a day's work for the Gardner-Denver Mining Specialist. It's also his job to record suggestions from mine operators and drill runners for product changes that will improve performance.

This exchange of knowledge benefits both company and customer—resulting in drilling equipment that is designed for the work to be done. No customer buys *just* a drill from Gardner-Denver. With his purchase, he benefits from all the extra services that make the difference between an acceptable and an outstanding customer-supplier relationship. That's why it's good business to call your Gardner-Denver Mining Specialist.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

Save on construction costs with the new '61 FORD TRUCKS

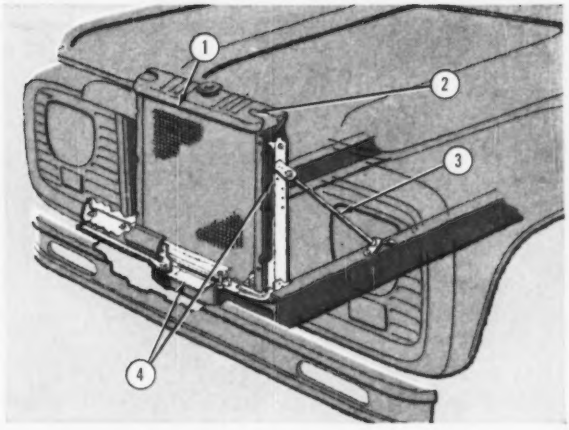
FORD HEAVIES SAVE WITH DOUBLE THE CAB, SHEET METAL AND RADIATOR LIFE

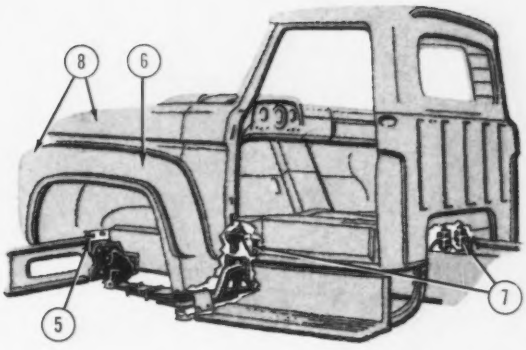
Ford F-Series Heavy Duty models are especially designed for the rugged terrain and tough conditions generally found on construction jobs. Their new independent mounting system for cab and radiator effectively separates both from adjacent sheet metal assemblies for much greater durability. And radius rod-leaf type rear springs provide better axle alignment, a smoother ride and longer spring life.

The electrical wiring system has been improved for greater reliability. Chassis wiring is fastened within the protection of the frame web, away from mud, ice and snow. And Ford Truck frames have been engineered to make the mounting of bodies and special equipment easier. A new 212-inch wheelbase model is available to accommodate extra-long bodies.

Save with Ford T-Series Heavy Duty Tandems for exceptional durability, big payloads and low operating expenses. Ford T-700, T-750 and T-800 Tandems have rugged double-channel frames that are built to take tortuous off-road treatment. And they provide a wider range of chassis options so you can choose the right power train and load-carrying components for any job. Eaton and Timken rear axles are now available in bogie assemblies with 22,000-, 28,000-, 30,000- and 34,000-lb. capacities. And lightweight aluminum walking beams, wheels and gas tanks are available to keep chassis weights low . . . payloads high.

Ask your Ford Dealer about Ford's full tandem line . . . including Super Duties with 38,000-lb. bogies for up to 51,000-lb. GVW!





① **Save with Ford's exclusive "lock-seam" radiator construction** that doubles the solder area at key seams for greatly increased strength and longer radiator life.

② **Save with heavier-gauge metal on radiator tank and header.** Tanks and header have thicker walls to resist vibration, jolts and corrosion for greater reliability.

③ **Save with independent radiator mountings,** separate from front-end sheet metal. This means that road shocks and shakes are not transmitted to the radiator through sheet metal . . . tanks, tubes and connections last longer, require less maintenance.

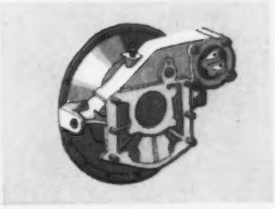
④ **Save with "horse collar" mounting** for extended radiator life. This new mounting on resilient rubber at the center of frame cross member soaks up any frame flexing . . . cuts wear and tear on entire cooling system.

⑤ **Save with independent fender mountings.** Fenders are bolted to a rubber-cushioned transverse bracket at the front and a frame-mounted bracket at the rear. This mounting, independent of both cab and radiator, eliminates stress transfers for increased fender life.

⑥ **Save with removable fenders.** The quick and easy removal of only 8 bolts per fender provides faster service accessibility to the engine area, saving valuable maintenance time.

⑦ **Save with new 3-point cab mounting system** for greater cab durability. Two outboard front mounts plus a centered "twin" rear mount provide a triangular system that holds the cab stationary while allowing the frame to move independently . . . reducing strain on the cab.

⑧ **Save with 42% heavier-gauge sheet metal** in fenders, hood, cab floor pan and toeboard for greater strength, greater durability.



Save with Ford's new Full-Torque flywheel power take-off . . . now available on T-750's and up, to power construction equipment like transit mixers. It's much simpler and more efficient than long, complicated hookups needed with the front-end drives. And the flywheel PTO is lighter in weight—only 105 pounds—for greater payloads.

FORD TRUCKS COST LESS

YOUR FORD DEALER'S "CERTIFIED ECONOMY BOOK" PROVES IT FOR SURE...

FORD DIVISION, Ford Motor Company

STATIC
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Step up and meet the big 270-B . . . longest range 2-crawler stripping shovel ever built! There's a new crowd system . . . all-enclosed gear-propelling . . . automatically lubricated, all-enclosed main machinery . . . and dynamic **STATIC CONTROL.** Here's control that lets you handle this million-pound giant like a small rig . . . that eliminates rotating parts and expensive electronic tubes. It delivers split-second response with a higher bail pull at any selected speed, reduces shock loading and puts the greatest digging force and speed to work the instant they're needed. It's control like you've never seen before . . . it's **STATIC CONTROL** — first by Bucyrus-Erie. Your operations can use this kind of performance . . . and we'll rush you all the details if you'll write Bucyrus-Erie Company, South Milwaukee 1, Wisconsin.

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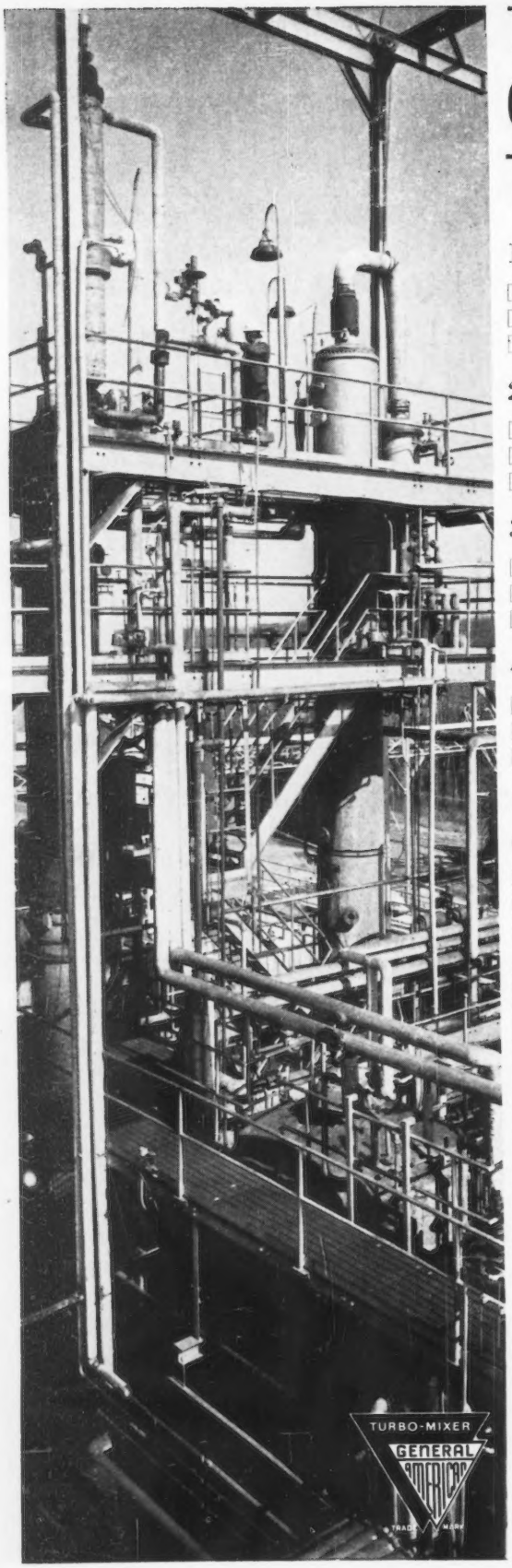
The only moving part on the STATIC CONTROL system is the operator's hand on the controller!



TRY THIS SIMPLE QUIZ ABOUT THE **RDC** COLUMN

1. ***R.D.C. stands for***

- ☐ a) Rapid Dispersion Column
- ☐ b) Recycle Displacement Column
- ☐ c) Rotating Disc Contactor

2. ***RDC Columns are made by***

- ☐ a) 6 different manufacturers
- ☐ b) by one manufacturer
- ☐ c) by 10 manufacturers

3. ***The RDC column has been used for***

- ☐ a) Separation of Hafnium from Zirconium
- ☐ b) Caustic extraction of acids from organics
- ☐ c) Caffein and vanillin extraction

4. ***The RDC column can be used for***

- ☐ a) liquid-liquid extraction
- ☐ b) liquid-solid extraction
- ☐ c) liquid-slurry extraction

5. ***The RDC column has which of these advantages***

- ☐ a) High volumetric efficiency
- ☐ b) No interstage coalescing or external settling
- ☐ c) Low power requirements

Answers

1. (C) Rotating Disc Contactor

2. (B) RDC columns are made only by the Turbo-Mixer Division of General American Transportation Corporation for all industries except petroleum. Manufacture is licensed under Shell Development Corporation patents.

3. (A), (B) and (C). For a complete list of typical systems in service, contact General American.

4. (A), (B) and (C) again. The RDC column is one of the most versatile tools available for extraction processing.

5. (We did it again—all three are correct).

If you'd like more information on the RDC column and the many advantages it offers, send for Bulletin T-1159. You'll find it pays to plan with General American.

Process Equipment Division—Turbo-Mixers
GENERAL AMERICAN TRANSPORTATION CORPORATION
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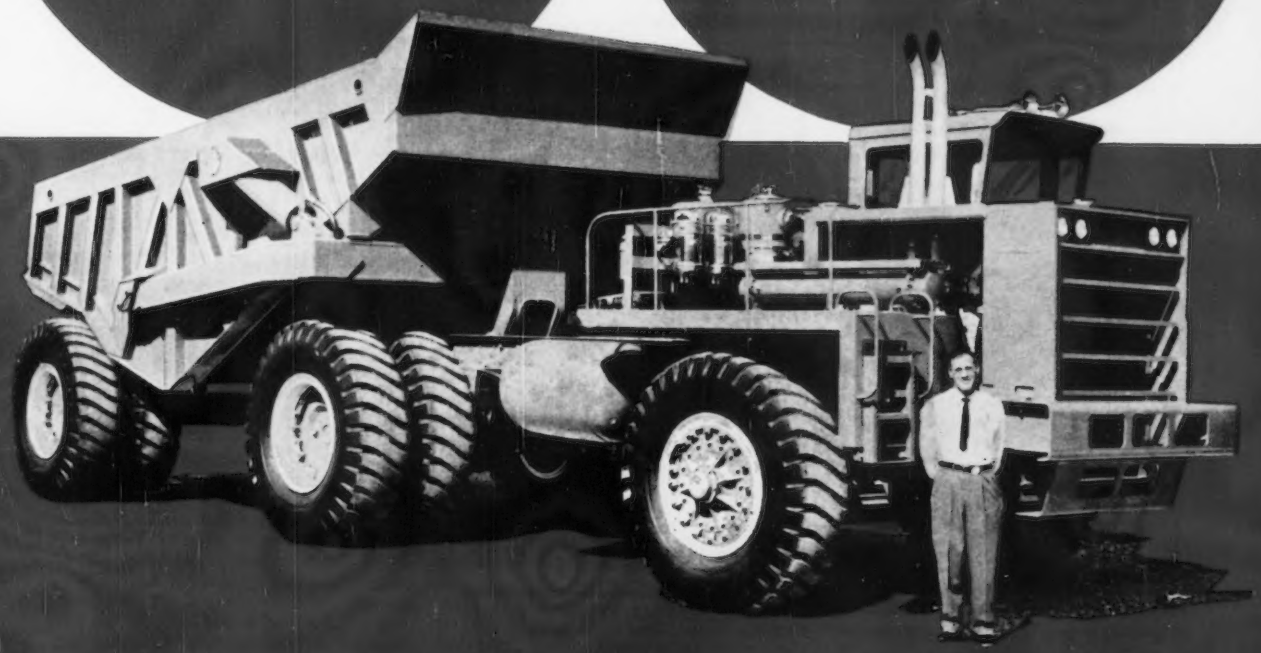
95

Carrying a 95-ton payload, this new KW-DART 95EDT is the largest production truck in the world. This achievement is proof again of KW-DART'S "Engineering know-how" and an important contribution to industry of the world.

Outstanding features include: 700-H.P. single diesel engine, torque converter and transmission; KW-DART triple reduction planetary drive rear axle; high strength, variable section alloy steel frame. The tractor-trailer design provides extreme maneuverability.



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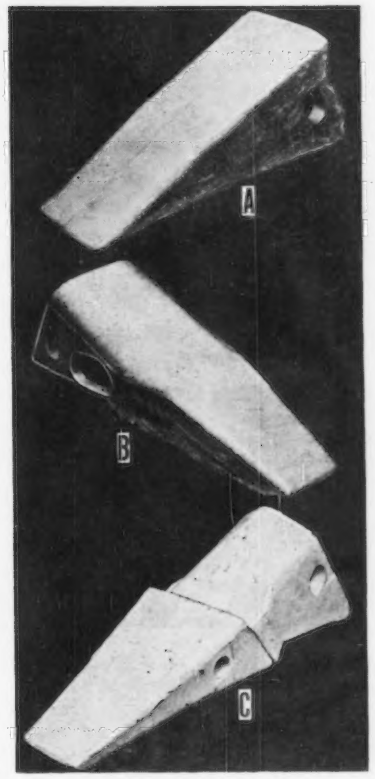
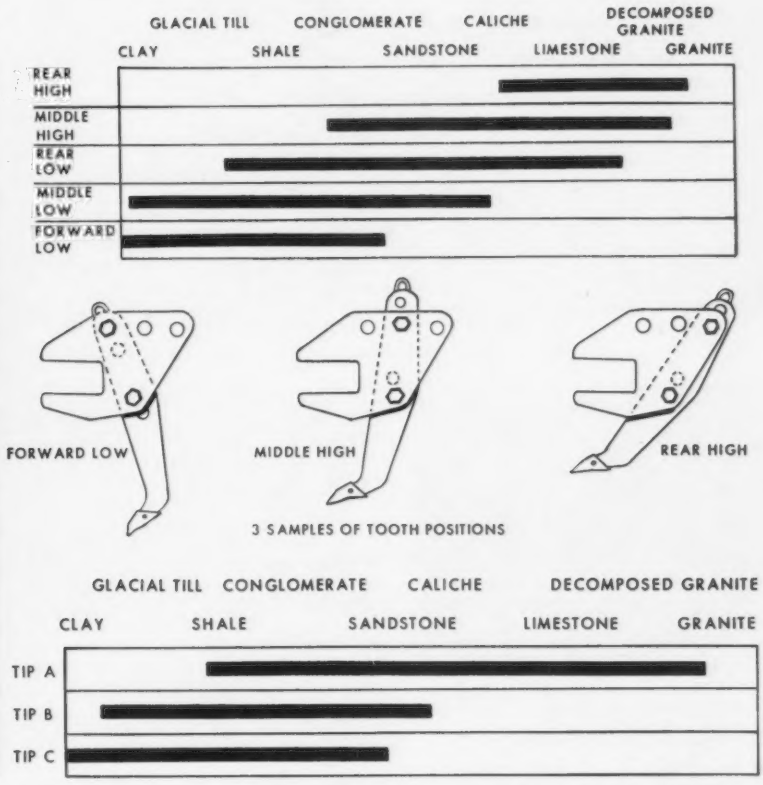
TR-44

MANUFACTURERS OF HOT METAL CARS, CINDER AND SLAG CARS, LADLE TRANSFER CARS, SMELTING & REFINING EQUIPMENT



Caterpillar bits for (A) hard material; (B) self-sharpening; and (C) abrasives.



Top chart shows optimum clevis positions for varying degrees of rock hardness. The bottom chart shows suggested uses of Caterpillar tips A, B and C.

Caterpillar Suggests Bit-Selection Criteria for Ripping Work (1)

THE RESULTS OF ROCK-RIPPING TESTS conducted by the Caterpillar Tractor Co. suggest that five factors should be considered in the selection of a proper tip for the job at hand: (1) rock hardness, (2) rock abrasiveness, (3) tip strength, (4) tip shape, and (5) the "ripping angle" formed by the top of the tip and the level ground. Emphasizing that the same general criteria apply to selection of any make tip, the Caterpillar Co. found three of its own tips suitable to the following operations:

The first material: extremely hard limestone. Tip A (above, 1) was selected for its strength and wide (4-in.) point, and provided good penetration, although rock hardness caused disabling blunting after only 15% wear.

The second material: sandstone overburden. Tip B, narrower (2½-in.) than Tip A, and undercut to ensure self-sharpening, was successfully used until worn down by 30% to the shank cavity.

The third material: decomposed sandstone. Because of the extreme abrasiveness of the friable sandstone, a tip-and-boot combination, Tip C, was selected. Here, the strength of a one-piece tip was not needed and the small, inexpensive 3-in. tip could be replaced easily after 50% wear.

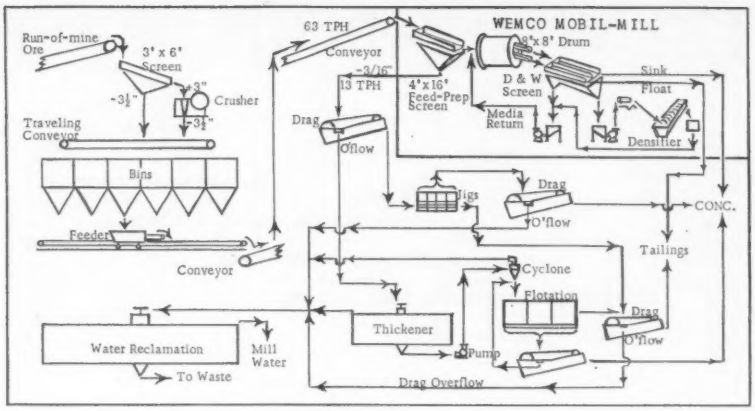
The bottom chart (above, r) shows suggested applications of the A, B, and C tips. Tip B has proven best as a "general purpose" instrument; however, the company stresses the importance of careful choice for economical operation.

The test-results indicate that the fifth factor, "ripping angle", should be between 40° and 50°. These angles are determined by the clevis, or tooth-mounting. There are two major types of clevis: the parallelogram mounting, which keeps the tooth at one angle at any depth, and the multi-position clevis which allows the bit to be set at the optimum-result angle for any material and depth. The top chart (above, r) summarizes the settings of a five-position clevis according to material hardness.

Moisture-Density Tester (11)

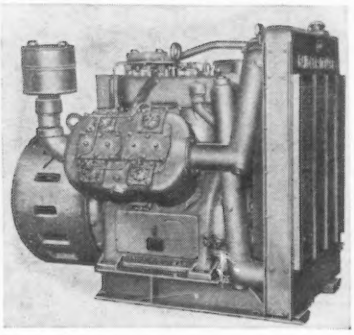
TWO NEW NUCLEAR-PRINCIPLE instruments made by Soiltest, Inc. provide convenient, fast and accurate measurement of moisture content and density of earth materials. The Surface Moisture Probe, Model NU-3, when connected to a portable scaler unit, measures the moisture content of a semi-spherical volume of material on which the probe is placed. Moisture is measured in a range of from 0 to 50% water by volume, and from 0 to 32 lb water per cu ft of material. Calibration curves supplied with the probe permit easy conversion of the scaler readings to the water volume percentage figure.

The Surface Density Probe, Model NU-2, measures the density of materials in the range of from 60 to 160 lb per cu ft. This unit contains a sensitive Geiger-Mueller detector, a gamma-emitting radioactive source, a transistorized preamplifier and shielding. For calibration purposes, the probe is placed in the carrying case, which contains a density standard.



Portable Mill in Mn Plant (5)

COMPANIA MINERA AUTLAN, S.A. DE C.V., has installed a Mobil-Mill, made by Wemco (division of Western Machinery Co.) as an integral section of its manganese ore-dressing plant at Autlan, Jalisco, Mexico. The mill, with an 8x8-ft drum separator, averages 80% recovery at about 47% manganese. The plant treats 63 tph of minus 3½-in.x3/16-in. material, which runs from 25 to 30% manganese.



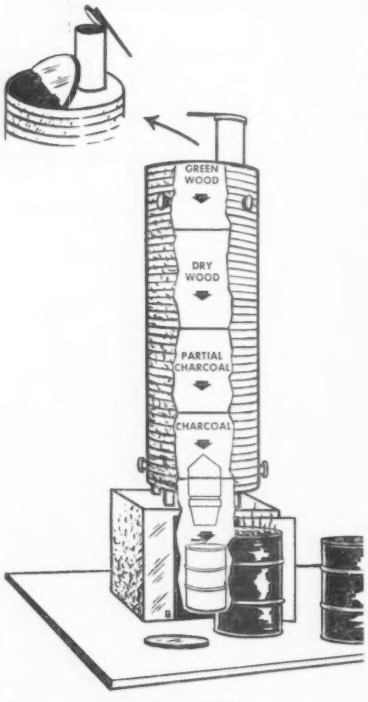
125-psi Air Compressor (6)

GARDNER-DENVER CO. offers a new air compressor, the Model WFO, which produces 125-psi air pressure from a 250-hp, 1160-rpm electric motor. The compressor is of vertical, W-type, two-stage design with 4-hp and 2-hp aluminum cylinders in a water-cooled bank. Piston displacement is 1395 cfm. The compressors are available in three models: with a built-in motor, a direct-connected motor, or a V-belt drive take-off sheave.

FM Two-Way Radio (9)

POCKET-SIZED "Handie-Talkie" transistor FM radio transmitter made by Motorola, Inc. operates on two VHF frequency ranges, from 25 to 54 mc and from 132 to 174 mc, and is claimed to give consistently better ranges than tube models. The radio can be operated from either rechargeable nickel-cadmium batteries or mercury cells. The batteries will give up to 9-hr operation between chargings; the mercury cells have a 400-hr working life. Either method of operation provides 500 milliwatts rf power output.

The Handie-Talkie is completely self-contained, and has two antennas: a solid steel whip and a collapsible whip. The transmitter can be used for communications, with either mobile radiotelephones and base stations or with a pocket-sized Motorola VHF receiver mate. The transceiver combination is shown in the photo: transmitter left and receiver right.



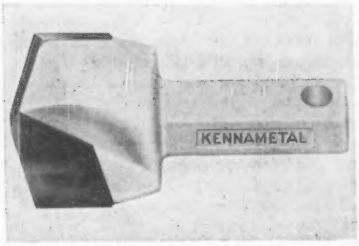
Charcoal Retort (40)

NEW LOW-COST semi-portable continuous retort for making charcoal has been developed by Continuous Charcoal Retort Co. It's 12 ft long and 4½ ft wide and weighs 3,200 lb. According to the company, no on-site utilities are needed —the operation only calls for firing up the cylinder and shutting off the air.

The unit's capacity is a cord of green wood or scrap which is converted in eight hours to 1½ tons of charcoal.

The company's continuous retort automatically dumps the charcoal into steel drums, which are then covered and cooled.

STAUFFER-TEMESCAL CO. has re-divided into two companies after a six-year merger. One, the newly-named Stauffer Metals Co., will remain on the Richmond premises, and will retain sole rights for the sale and licensing of electron beam melting and casting furnaces, developed jointly with the Temescal Metallurgical Corp. The other, Temescal Metallurgical Corp., has moved to new facilities in Berkeley, Calif.



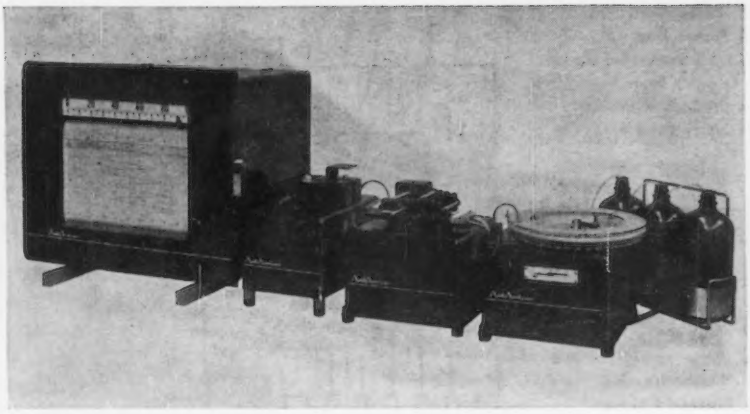
Improved Roof Bit (19)

THE MINING TOOL DIV., Kennametal Inc., has redesigned its FDC roof bit to keep pace with the increasingly powerful rotary and rotary percussion roof drills.

The bit's drilling forces have been distributed over a larger area-seating surface between the base of the bit and the drill steel chuck has been substantially increased. The larger force area, Kennametal said, will be a tremendous advantage where high thrust or rotary percussion-type drills increase impact loads and rate of wear. The more rigid support of a square shank with cross-sectional area increased by removal of water grooves.

Metal Repair Mixture (14)

EPOXY-ALUMINUM mixture made by Devcon Corp. forms a strong adhesive bond when applied to metal, and may be used to repair castings, valves, pumps, etc. The material, named Devcon F, a hardening agent, and an applicator paddle may be bought together in a repair kit. The mixture contains 80% aluminum, and 20% epoxy resins and modifiers.



New Unit Continuously Spots Sulfur Dioxide (8)

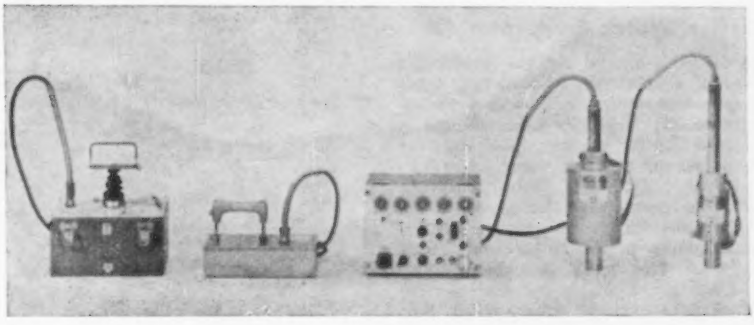
MEASURING UNIT, developed by Technicon Controls Inc., employs the principle of colorimetric determination to detect sulfur dioxide contaminants in the atmosphere. The TCM AutoAnalyzer—as it is called—is a compact and complex system, which will take and measure 130 air samples per day on a continuing, entirely automatic schedule. The AutoAnalyzer is sensitive to contamination levels as low as 0.006 ppm, and performs the normal laboratory test steps of sample measuring, mixing, purifying, processing and comparing to obtain permanently recorded results. The system's modular construction permits complete flexibility of arrangement for plant or laboratory use. The basic "building blocks" perform a number of specific operations that can be flexibly interconnected to provide any analytical sequence required by the user.

Moisture-Density Tester (10)

NUCLEAR-CHICAGO CORP. manufactures a portable system of instruments for the measurement of moisture and density of soil and other materials, both on and below the surface. Trade-named the d/M-Gauge, the system consists of an electronic readout unit and four separate sensing probes which detect: (1) surface moisture (2) surface density (3) depth moisture and (4) depth density.

The two surface sensers are suitable for use in field compaction control on soil or aggregate fills, and for non-destructive testing of concrete, asphalt and related construction materials.

The two depth sensers may be used to depths of 200 ft, by insertion in bore holes through access tubing. They are suitable for use in pre-construction evaluation, in the determination of soil support failures and the effects of loading, freezing, thawing, drainage, etc.



The d/M-Gauge system does not affect the test material and requires only a single coring for a long-term study.

Safety Switch Prevents Damage (30)

A "MOTION SAFETY SWITCH" made by Fuller Co., Catasauqua, Pa., may be used to control a motor circuit or to operate a warning signal device to protect equipment systems from the damage of sudden stoppage.

Since stoppage is often caused by a minor part failure, the cause is often not detected and equipment shut down before damage becomes progressive. The device will automatically cease an entire interrelated equipment process when one component breaks down. Accordingly, the switch is intended for use on components which are crucial to the safety and operation of related equipment.

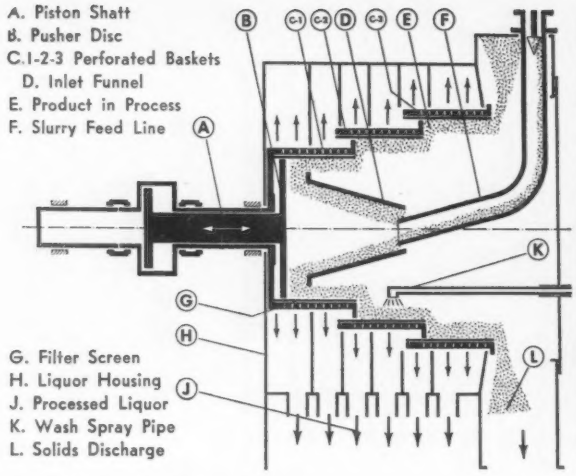
Seatless Check Valve (31)

THE TECHNOCHECK, a simple, seatless check valve developed by Techno Corp. of Erie, Pa., is said to give unusual efficiency and economy in air, gas, oil, water and other fluid lines. Standard or custom designs from 1 in. to 36 in. are available in a wide pressure-temperature range, up to 300 P.S.I. and 500 deg. F.

The valve employs the valve wall as a seat for two center-hinged flaps. The flaps assume a streamlined position with discharge from compressor, blower, or pump, and give smooth, hammer-free action on low pressure differential. When flow reverses, the flap-elements instantly expand against the valve wall, giving an airtight seal.

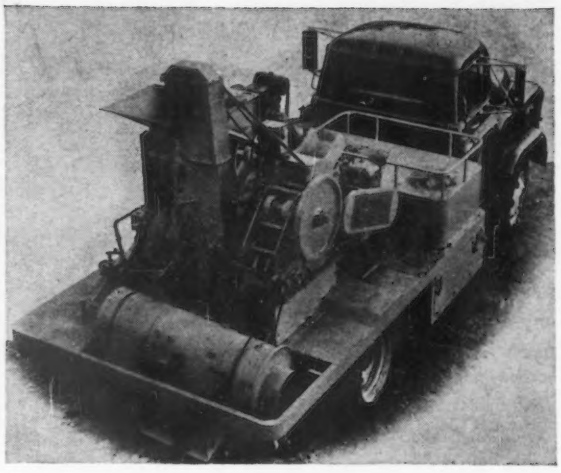
Two-Color Pyrometer (3)

AUTOMATIC, TWO-COLOR PYROMETER, developed by Shaw Instrument Corp., permits observation and temperature measurement of molten or solid metals, either stationary or in motion. The instrument, which consists of a sensing head and a remote indication and recording unit, may also be used to control vacuum melting and combustion rates. The pyrometer gives accuracy of $\pm 20°F$ from temperatures below 4000°F, and $\pm 50°F$ from temperatures above 4000°F. Response is fast and free from emissivity effects. Since relatively little radiant energy is required to cause proper indication, temperatures may be measured from as far as several hundred feet.



Multi-Step Centrifuge (15)

BAKER PERKINS, INC., Saginaw, Mich., manufactures a multi-step slurry centrifuge, of Escher-Wyss design, with a "telescoped" basket-drum design which allows the cake to move smoothly without buckling, and with ample time for thorough drying. Slurry is fed to the face of a short-stroke, reciprocating plunger-plate located at the "eye" of the telescoped drum. The plate tamps the slurry along the drum's first step into its widening, stepped circumference. This slight axial-tamping ensures a smoothly accelerating flow of slurry toward the outlet aperture.



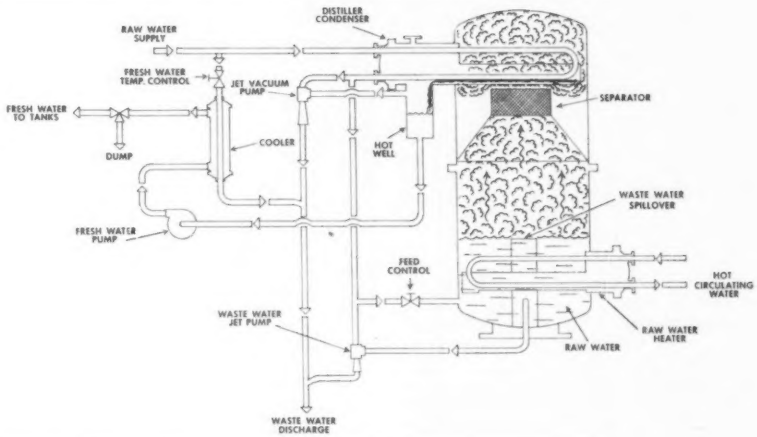
Truck-Mounted Concentrator (16)

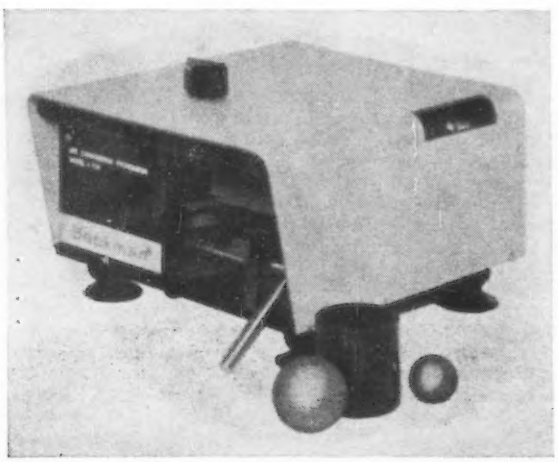
A TRUCK-MOUNTED gravity-flotation mill, the Ore-Bee, manufactured by Shelton-Cheney Mining Co., Edmonds, Wash., combines crusher, pulverizer, concentrator and elevator, and can be operated by one man. The mill is said to have a capacity of from 10 to 15 tpd with ore grades of from "the finest stages" to 10-mesh, and to permit up to 98% recovery. The concentrator's riffles are interchangeable and the drum is self-cleaning. The manufacturer states that the mill is suited to a wide range of mining applications, but should prove of particular benefit on gold properties hitherto unprofitably worked.

Saline Water Evaporator (2)

AMF CO.'S MAXIM DIV. has developed a line of evaporators, trade-named Aquavap, which utilizes hot water from engine-cooling jackets or other sources as a heat-transfer medium. The Aquavap boils sea or brackish water under vacuum at 125°F, and allows very little scale to form. The electric power requirements for the evaporators' pumps and salinity panels range from .20 to 3.75 kw. The "fresh" is 4 ppm pure.

Units are available for use with engines (where jacket water, rather than hot water from some other source, is used) of from 30 to 2500 hp. Output is roughly 5 gpd per unit of horsepower, or from 150 to 12,500 gpd.





Air Comparison Pycnometer (18)

BECKMAN SCIENTIFIC & Process Instruments Div., Fullerton, Cal., has introduced an air comparison pycnometer (model 930) which gives rapid, non-destructive volume measurements of the density and porosity of irregular, powdered and porous solids. The device is hand operated and requires no power source.

The pycnometer may be applied to ore sample and mineral purity evaluation, core analyses for porosity percentage, and porosity calculations of bearing metals. Volume measurements accurate to better than 0.1 cc can be obtained, and no liquids, gas pressure, or temperature controls are needed. A measurement may be made by an unskilled operator in one minute, with no problems of wetting, bubbling, flotation, or solubility to consider.

For Your Files

This selected manufacturer's literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.

HEWITT-ROBINS has just published a 22-page bucket elevator and belt guide. The booklet contains engineering data on various elevators and recommends the grades of belting best suited for raising materials of different weight, abrasiveness, and temperature.

H-R's presentation is packed with tables and details of elevator belt splicing, belt and cover thicknesses, bucket application and splicing, and ends it all with a very valuable glossary of bucket elevator terms. **(80)**

NATIONAL SAFETY COUNCIL has just come out with a series of booklets designed to be an effective, low-cost safety training course for industrial foremen.

The course, written by Glenn Griffin on the University of Michigan's Bureau of Industrial Relations, is called "Men and Motives in Safety Supervision," and each of the six booklets will serve as a one-hour training session. **(81)**

HOYT WIRE CLOTH CO.'s new handbook is a reference manual containing general and technical information on wire screens and their use. In addition to the usual wire cloth tables, it contains square footage, decimal equivalent and equivalent size charts, as well as information on crimp types, edge types and wire sizes.

Hoyt's publication also has formulas for determining open areas in various types of wire cloth, weight per sq ft, and conversion of opening to meshes per in. **(82)**

OPERATIONAL and specification data on air line oilers (half pint to five-gal capacities) are presented in a new and comprehensive bulletin (LO-2) from Gardner-Denver Co.

The company begins by pointing out the basic advantages of line oilers and then, after describing various size models, lists the data on care and operation of pipe lines, hoses and lubrication. **(87)**

ATTRACTIVE new 14-page booklet (L-1057), "Modern, Profitable Mining Methods with the 630 Crawler Series," has just been published by the Eimco Corp.

Included is a short outline of the development of these crawler-mounted air or AC electric powered machines, which, Eimco claims, has revolutionized mining, shaft-mucking and loading. Great deal of pictures and illustrations show the various attachments that can be mounted onto the 630 and also show the unit operating under varying conditions at several mining sites. **(83)**

NEW DESCRIPTIVE brochure on Spiratube, its construction and uses, has just been published by Flexible Tubing Corp. The four-page booklet gives specifications of the lightweight, rugged, portable duct which is used for ventilation, materials handling, and fume and dust removal systems. **(98)**

TROJAN POWDER CO. has published a 16-page bulletin (101) describing their high explosives, seismic explosives for land and off-shore exploration, nitrocarbonitrates, primers and boosters, etc. **(84)**

SIX-PAGE brochure prepared by Eriez Mfg. Co. describes their complete line of unit (bin) vibrators.

The company said that nine models are available and that all are ac operated, needing no rectifiers and that all give pinpointed vibration for top performance on hoppers, bins and chutes.

The HI-VI bin vibrators, according to Eriez, produce double impact because the hammer strikes the anvil on both top and bottom of the stroke, giving 7,200 impact per minute. **(85)**

60-PAGE CATALOG on wide inner ring ball bearings and power transmission units has just been published by the Fafnir Bearing Co.

Wide inner ring bearings, according to Fafnir, are designed for users who need ball bearings which can be easily mounted on straight shafts and positioned without shoulders, locknuts or adapters. **(86)**

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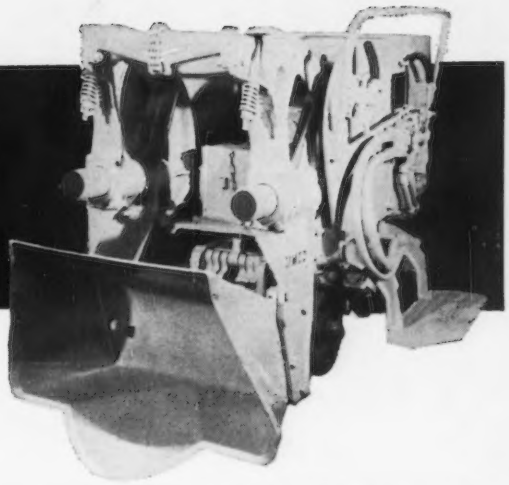

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A. Bucket Down Position
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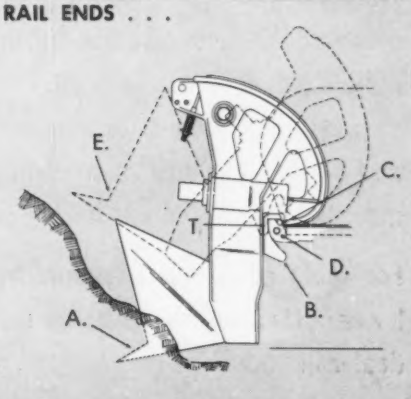

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Expanded range of discharge heights.
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FAMOUS EIMCO QUALITY AND CRAFTSMANSHIP.

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181 EIMCO FILTERS

Uranium Processors Choose Eimco Filters 4 to 1!

In Canada's Elliot Lake uranium producing area there are 181 Eimco drum and disc filters installed for acid leach and yellow cake processing. Why this preference for Eimco?

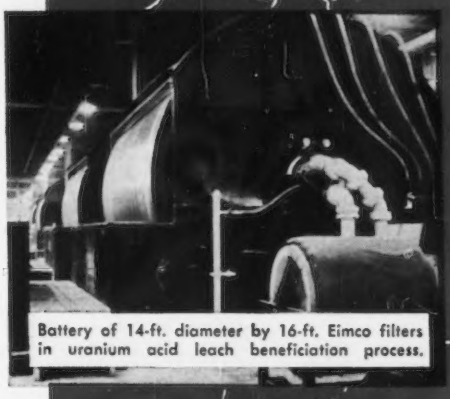
When mining men were trying new methods for uranium beneficiation, Eimco was able to offer, for their guidance, an unsurpassed backlog of past experience in building and applying filtration equipment for ore dressing.

Eimco's research and development staff undertook exhaustive studies of equipment adaptations that would be needed for profitable recovery. Recommendations were pre-tested in Eimco's modern laboratory and pilot plant before investments in equipment were made.

All Eimco equipment "proved out" right from the start. Eimco's streamlined Hy-Flow valve, for example, was first introduced on uranium filters to cut vacuum loss. In a test in the Elliot Lake area, pressure drop across these valves proved to be negligible.

The Eimco representative in your area can show you how Eimco engineering and equipment can keep tonnages up and costs down in your operations. Call him, and write Eimco Filter Division for new Filters Bulletin F - 2049.

Six-foot diameter Eimco drum filter is one of many producing yellow cake in Elliot Lake area.



Battery of 14-ft. diameter by 16-ft. Eimco filters in uranium acid leach beneficiation process.

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Next time you watch track shoes squeal and grind against jagged rock . . . or see 'em buried sprocket-deep in mud, consider this: Nothing slugs it out with tough conditions like an Allis-Chalmers tractor undercarriage.

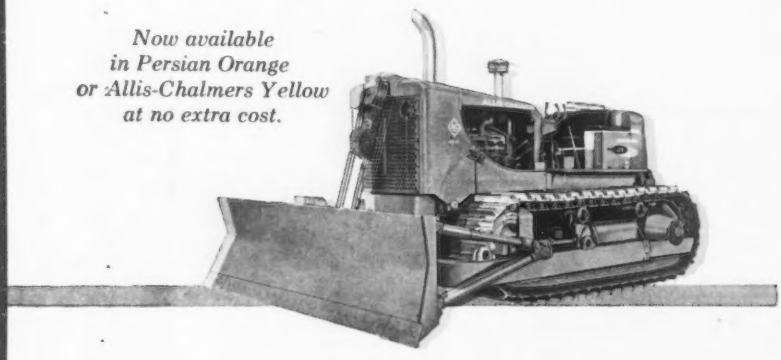
Specially heat-treated track shoes, side bars, track pins and bushings are the industry's toughest. Bushings extend into counterbored side bars to seal out dirt, provide more bearing area.

Track guiding truck wheel guards provide a deep-flanged guide channel that keeps track riding true on sprockets, idlers and truck wheels even in the roughest and toughest going. The solid A-frame holds the truck frames in absolute alignment — keeps track running straight.

PERMA-SAFE truck wheels, idlers and support rollers on all Allis-Chalmers tractors roll on tapered roller bearings, are protected against dirt and moisture by Positive Seals. Factory-lubricated, they're certified never to need further greasing.

We invite a maintenance cost comparison with any other tractor undercarriage. We further invite you to inspect the Allis-Chalmers healthy, long-lived tractor engine, the all-steel main frame, double-reduction final drives and many other cost-cutting features. Your Allis-Chalmers dealer will be happy to give you full details. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

Now available in Persian Orange or Allis-Chalmers Yellow at no extra cost.



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power for a growing world

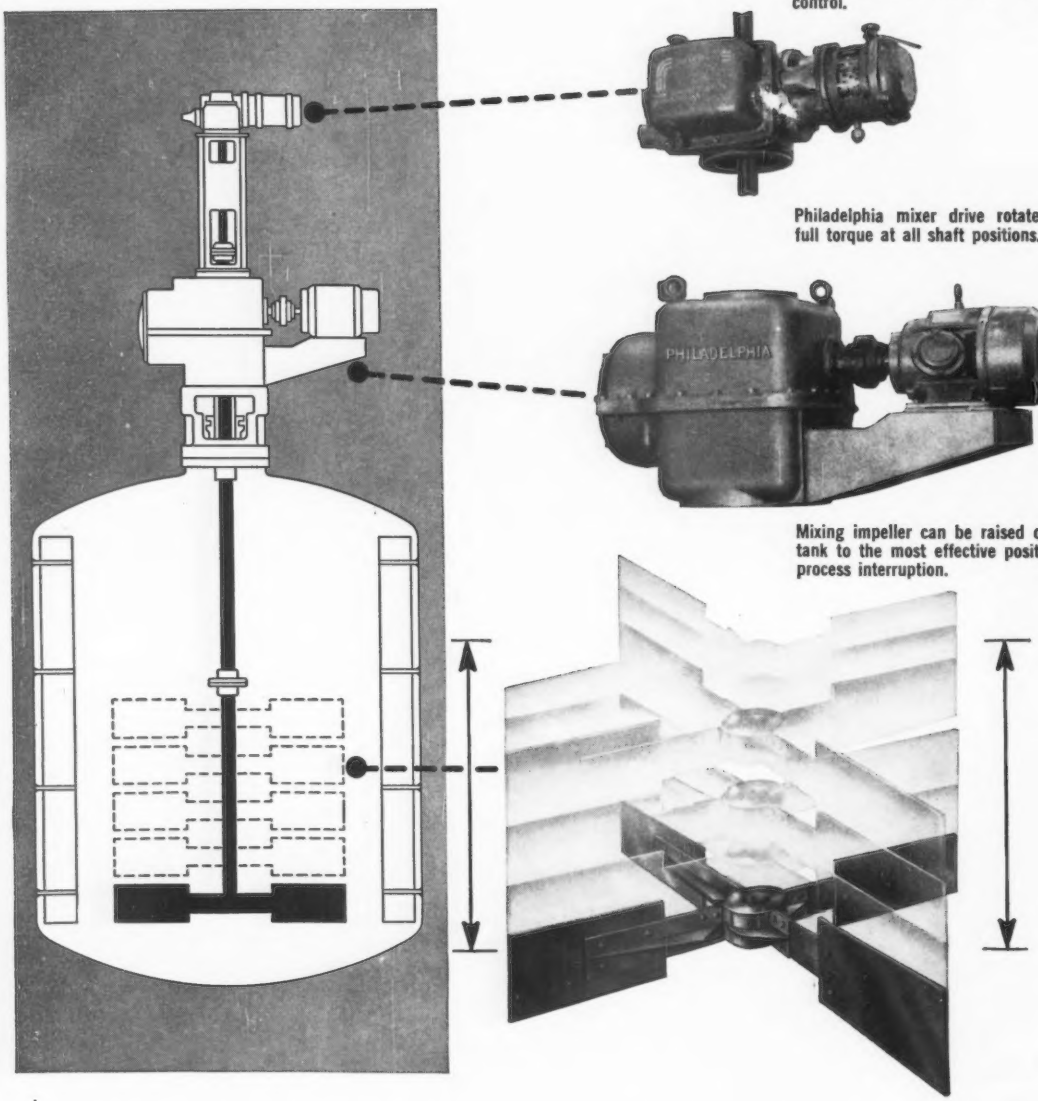
21

NOW...you can raise and lower mixing impellers with no process interruption...

Philadelphia Limitorque raises and lowers mixer shaft—either automatically or by push button control.

Philadelphia mixer drive rotates shaft—applies full torque at all shaft positions.

Mixing impeller can be raised or lowered in the tank to the most effective position . . . with no process interruption.



This combination of Philadelphia Mixer power transmission components gives you optimum mixer performance at all times. Mixing can continue at full tank pressure while impeller position is changed, and there is no danger of product contamination because it can be done without opening the tank.

Many processors are already taking advantage of this unusual mixer design feature. Why not learn how Philadelphia lifting-lowering mixers can improve the effectiveness of your mixing operations. For full information, send for Bulletin LL-60.

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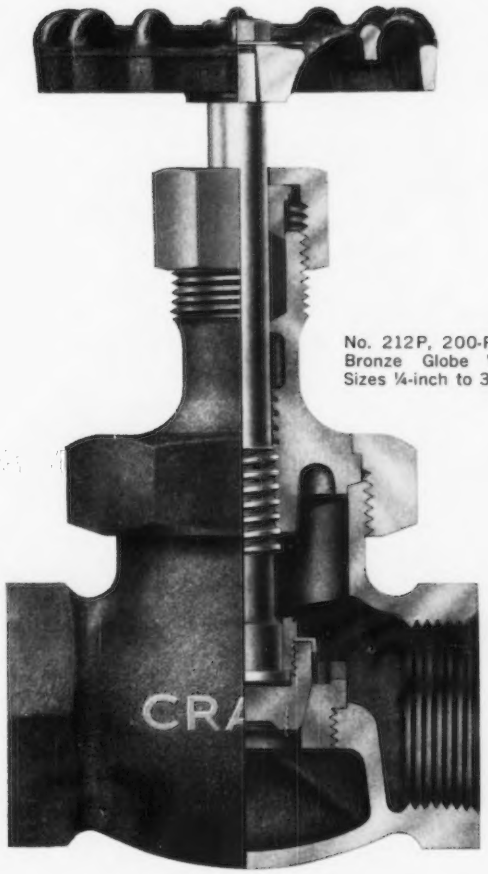
CRANE PLUG DISC BRONZE GLOBES



No. 212P, 200-Pound Bronze Globe Valve. Sizes ¼-inch to 3-inch.

These rugged valves are made for the toughest throttling jobs! Use them anywhere . . . on blow-off, boiler feed, soot blower, and drip and drain lines . . . then sit back and forget your maintenance worries.

Crane's "500 Brinell" stainless steel disc and seat give superior protection against corrosion and wear. The wide seating surface resists wiredrawing and damage from foreign matter. Deep stuffing box is filled with high grade packing.

Crane Plug Disc Bronze Globe Valves are made in 150-Pound, 200-Pound, and 300-Pound pressure classes, in a full range of sizes. Your Crane Distributor can ship your requirements from stock.

Crane Plug Disc Bronze Valves are also available in angle pattern

New! Write for your personal copy of Crane's Catalog 60. In it you'll find complete specifications on Crane's full line of bronze valves, and valves for every fluid handling service.

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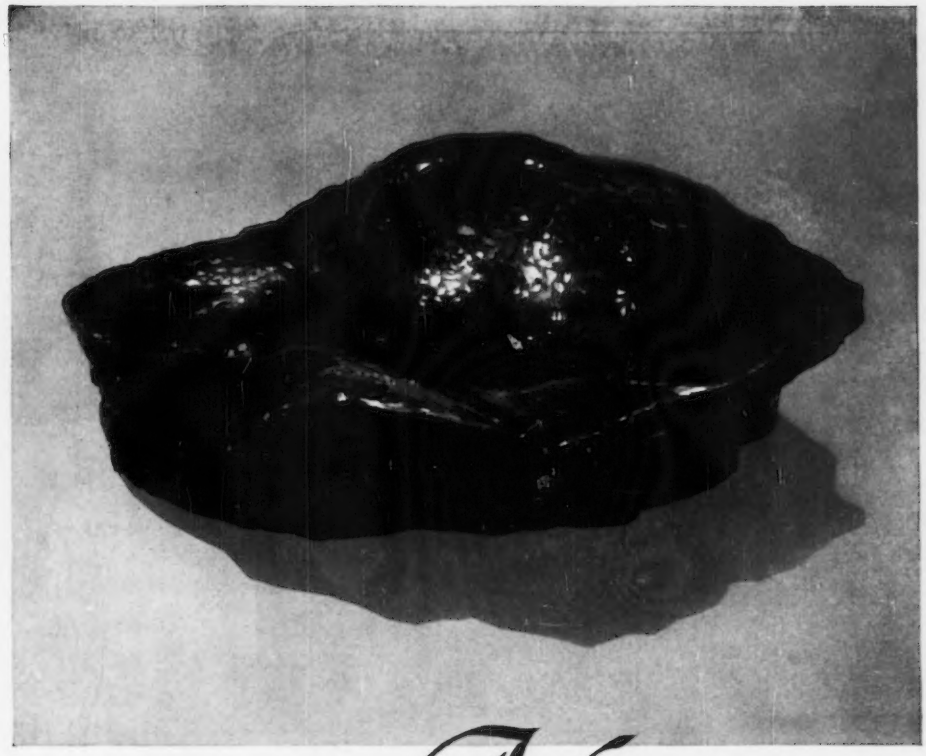
Miner...or Miser? You are looking at a man in the act of helping his employer save money. He is loading a hole with the new low-priced explosive, Du Pont HI-CAP.® This specialized explosive sacrifices nothing in quality or performance and gives you substantial economy except under the most severe conditions. Now available in four new small diameter grades for underground work, HI-CAP gives good fragmentation, good fumes. The denser grades also have fair to good water resistance.

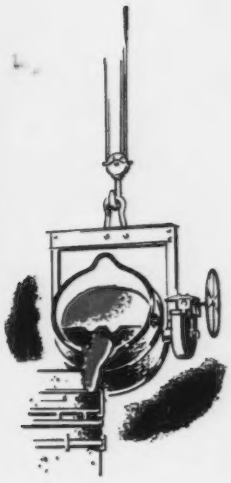
This is just one more example of Du Pont's down-to-earth approach in providing you a complete line of explosives to solve every mining problem. Your Du Pont distributor or representative can arrange trials to show what HI-CAP can do for you. Du Pont, Explosives Department, Room 6440 Nemours Building, Wilmington 98, Delaware.

Grade	Stick Count*	Water Resistance
HI-CAP 1	120	Good
HI-CAP 2	135	Fair
HI-CAP 3	150	None
HI-CAP 4	165	None

*1¼ x 8 cartridges per 50 lbs.

DU PONT EXPLOSIVES Better Things for Better Living... *through Chemistry*





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Derived from the Greek word meaning blood, or blood-like, Hematite was so named because of the reddish hue found in most of its varieties. This important mineral has indeed provided "life blood" for the iron and steel sinews of industry. For many decades, Hematite—the basic ingredient which feeds the blast furnaces of the world—has been one of the most important minerals of civilization.

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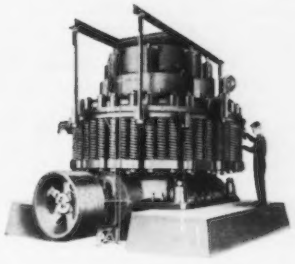

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Underground filmed report shows how one mine moves hard rock for less than 20¢ a ton . . .

You have probably heard of the Young Mine of American Zinc, Lead and Smelting Company and wanted to see their operation. It is believed to be one of the world's most economically-operated hard rock mines. Many have come to observe their methods, several from foreign countries. This mine operates two shifts. A total of only 95 hourly employees produce more than 3,000 tons daily. The low cost operation is the primary result of the tremendous tonnage moved by self-loading transports manufactured by Sanford-Day. Three of these S-D Transloaders, requiring only three men per shift, load, haul, and dump all the ore produced. Total cost is less than 20¢ a ton. This includes cost of original investment, maintenance and labor. Another feature of this mine that visitors observe and ask questions about with a great deal of interest is the haulage equipment. Only 28 S-D Automatic Bottom Dumping mine cars are necessary to haul the entire 3,000-ton daily production to tipple and it costs less than 4¢ a ton. We recently completed and have available now for your study a documentary 18-minute color-sound 16mm movie showing every phase of this low cost operation — from drilling to transportation of ore to mill. Ask us to mail this film to you for showing to your operating personnel . . . or, ask us to have one of our representatives bring projector and the movie to show for you. Write or call us today. Use coupon below to make mail request.

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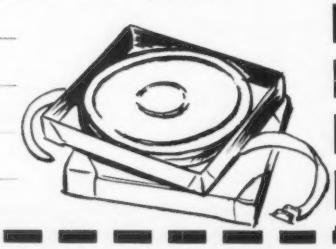
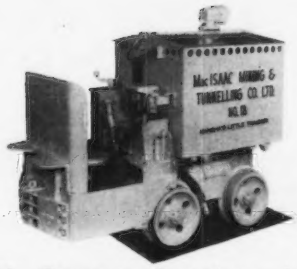
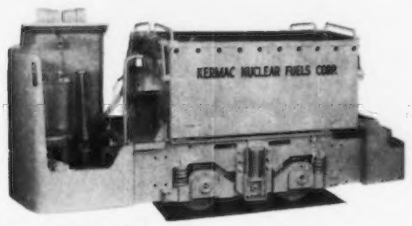


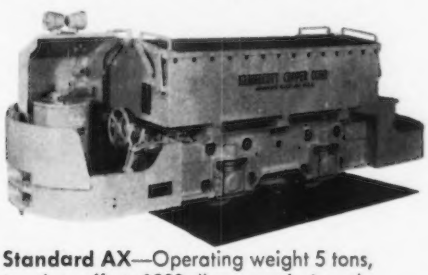


Little Trammer—Operating weight 1.7 tons, tractive effort 500 lbs, speed 4 mph.

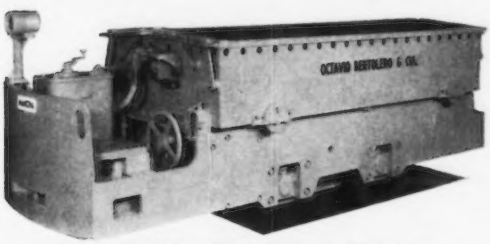
Titan BN—Operating weight 3 tons, tractive effort 800 lbs, speed 4 mph.



Titan ANX—Operating weight 4 tons, tractive effort 1600 lbs, speed 3.25 mph.



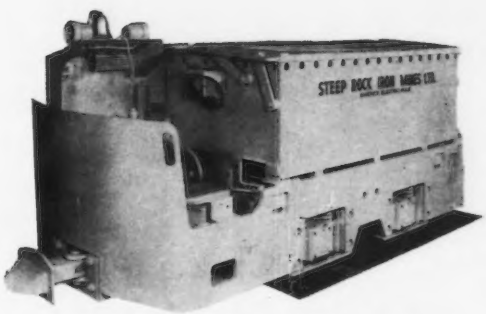
Standard AX—Operating weight 5 tons, tractive effort 1900 lbs, speed 4 mph.



Standard AX—Operating weight 6 tons, tractive effort 3600 lbs, speed 4 mph.

MANCHA storage battery locomotives

. . . A complete range of sizes for practical, low cost haulage service in metal and non-metallic mines.



Standard ABX—Operating weight 7 tons, tractive effort 2000 lbs, speed 4.25 mph.

Hercules BX—Operating weight 9 tons, tractive effort 4000 lbs, speed 6 mph.

Mancha specializes in fitting the locomotive to the job. Let us know your requirements.

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"My TD-24 almost equalled ...*My faster TD-25's*

size-bigger crawlers *deliver larger loads"*

—Charles W. McClinton, Oakman, Alabama

"Actual on-the-job demonstration proved my 4-year-old International TD-24's daily production approximately equalled size-larger competitive crawlers," reports Charles W. McClinton, for McClinton Coal Company, Oakman, Alabama.

"My TD-25's are faster all-around, and deliver larger loads than the '24.' Planet Power-steering lets the operator cut big loads faster (than a clutch-steered, king-sized crawler)—and delivers the loads at a constant speed without loss of power on turns."

"Dead-track drag" eliminated

Planet powered International TD-25's keep both tracks pulling full-time—to make full-load, full-power turns, or slam straight ahead with offset loads. And combined on-the-go, Hi-Lo power-shifting gives instant, up-or-down matching of power to condition.

You make full-load turns, and keep the blade loaded. You get constant-contact benching or highwalling, applying full power, getting full speed. "Dead-track drag" and "gear-shift lag" are eliminated.

Exclusive Planet Power-steering makes the TD-25 the industry's only power-shifted 8-speed gear-drive tractor or 4-speed torque converter tractor.

Power-shift and power-steer the 230-hp TD-25 on tough overburden removal, benching, and highwalling. Prove what it means to your operating efficiency to match or outproduce size-bigger, clutch-steered crawlers. See your International Construction Equipment Distributor!

International® Construction Equipment

International Harvester Co.,
180 North Michigan Ave., Chicago 1, Illinois
A COMPLETE POWER PACKAGE

Overburden 20 feet deep, half earth, half rock, is being removed here to get at a 16-inch coal seam. This McClinton-owned TD-25 cuts down highwall, and removes berms. Operator simply shifts load-side track to high range, leaves other in low range to keep "25" on course without "bank-nosing."

Planet Power-steering and on-the-go, Hi-Lo power-shifting teams with the 6-cylinder, 230-hp International DT-817 diesel—to pick up and "run" with loads like this, on the McClinton strip-mining operation. Dual valving makes this engine a "free breather," to give peak turbocharging efficiency.

THE STEEPER THE GRADE...

the more "extra" loads a cycle-gaining Payhauler® gives you

Of all three 27-ton off-road haulers, only the International 95 Payhauler gives you the weight-shedding, strength-multiplying advantages of the rock-ribbed, corrugated body. Only the "95" is plus-powered by the 375-hp DT-817 turbocharged Diesel. And only the "95" gives you an exclusive combination of power-control, safety, and comfort features that turns haul-speed advantages into extra haul-cycles! *Prove to yourself* what comparative grade charts and work-tally sheets show! See your International Construction Equipment Distributor for a Payhauler demonstration!

Positive Torqmatic braking gives the operator complete control of this fully-loaded "95"—builds confidence to use the highest practical haul speeds, even when hauling down the steepest grades. "One-hand" power-steering teams with finger-tip brake lever control to give course-holding, grade-matching downgrade hauling stability. Torqmatic braking, standard equipment on the power-shift "95," is a Payhauler *plus*—furnished in addition to the standard, internal-expanding wheel brakes—to help give you "*extra*" loads on tough hauls!

Grade charts prove: only the 95 Payhauler delivers

Total grade and rolling resistance, 10%

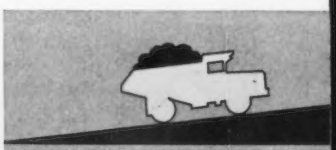
Hauler	Hauling Speed (mph)	Payhauler Advantage
95 Payhauler	10.2	
Competitor X	8.0	27.5%
Competitor Y	8.0	27.5%

Total grade and rolling resistance, 11%

Hauler	Hauling Speed (mph)	Payhauler Advantage
95 Payhauler	10.1	
Competitor X	7.0	44.3%
Competitor Y	7.5	34.7%

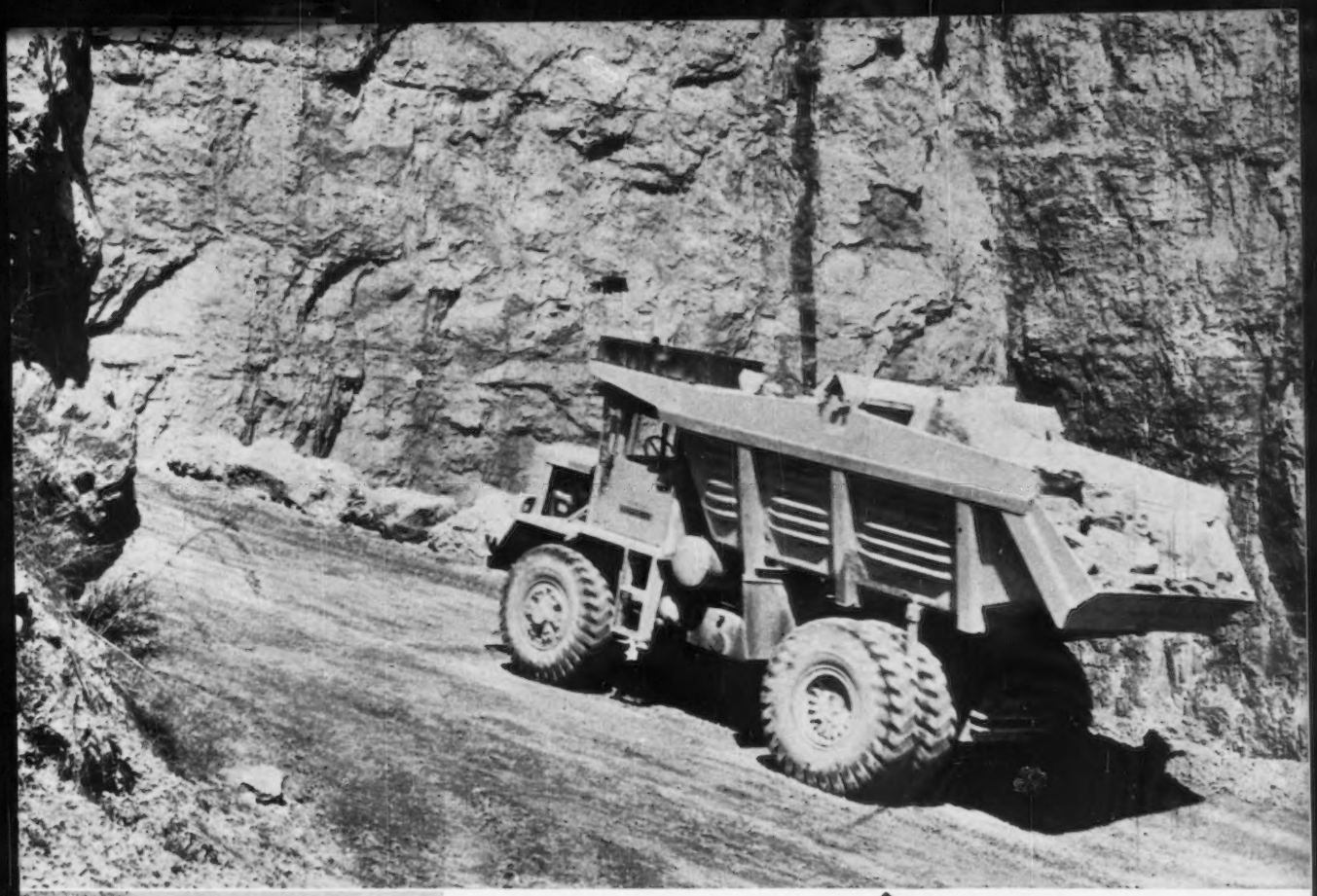
Total grade and rolling resistance, 12%

Hauler	Hauling Speed (mph)	Payhauler Advantage
95 Payhauler	9.0	
Competitor X	6.3	42.9%
Competitor Y	7.0	28.6%



Total grade and rolling resistance, 13%

Hauler	Hauling Speed (mph)	Payhauler Advantage
95 Payhauler	7.9	
Competitor X	5.5	43.6%
Competitor Y	6.0	31.7%



Two 65 Payhauler rigs speed full 19-ton loads of dolomite from quarry to crusher—up a maximum climb-out grade of 16%. Powered by the 250-hp naturally aspirated "817" Diesel—equipped with weight-shedding corrugated steel body—the "65" consistently hauls 30% faster than competitive rigs! Price the "65"—you pay less per hp, less per struck yard and per ton of capacity than for competitive rigs!

Three 95 Payhauler trucks replace five competitive haulers in a large Chicago-area quarry. Reasons: fully-loaded "95's" haul upgrade as much as 44% faster than the competitive make—give fast, "big-target" loading—dump in only 11 seconds with exclusive power-up and power-down hoist action. And the cycle-gaining "95's" with Torqmatic power-braking, power-steering and power-shifting deliver "extra" loads on steep hauls!

International Harvester Co.
180 North Michigan Ave.
Chicago 1, Illinois

A COMPLETE POWER PACKAGE

International®* *Construction Equipment

"extra" loads . . . over any 27-ton competitor

Total grade and rolling resistance, 14%

Hauler	Hauling Speed (mph)	Payhauler Advantage
95 Payhauler	7.2	
Competitor X	5.0	44. %
Competitor Y	5.5	30.9%

Total grade and rolling resistance, 15%

Hauler	Hauling Speed (mph)	Payhauler Advantage
95 Payhauler	6.4	
Competitor X	4.8	33.3%
Competitor Y	5.3	20.8%

Total grade and rolling resistance, 16%

Hauler	Hauling Speed (mph)	Payhauler Advantage
95 Payhauler	5.8	
Competitor X	4.6	26.1%
Competitor Y	5.0	16. %

Total grade and rolling resistance, 17%

Hauler	Hauling Speed (mph)	Payhauler Advantage
95 Payhauler	5.4	
Competitor X	4.5	20. %
Competitor Y	4.9	10.2%

Dollar Saving Efficiency

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LOW COST INSTALLATION

LOW COST OPERATION

LOW COST MAINTENANCE

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Low cost pumping —the built-in trademark of Wilfley Sand Pumps. Wilfley gives you low installation cost for the pump and prime mover. No auxiliary equipment necessary.

Long-wearing parts—few in number, are constructed of the best alloy metal or rubber-compound for your service. Wilfley's quick-change features allow speedy replacement of worn parts. Rugged, simple frame construction and packingless design guarantee trouble-free 24-hour service without attention.

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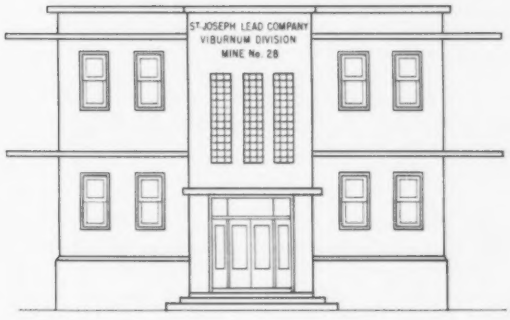
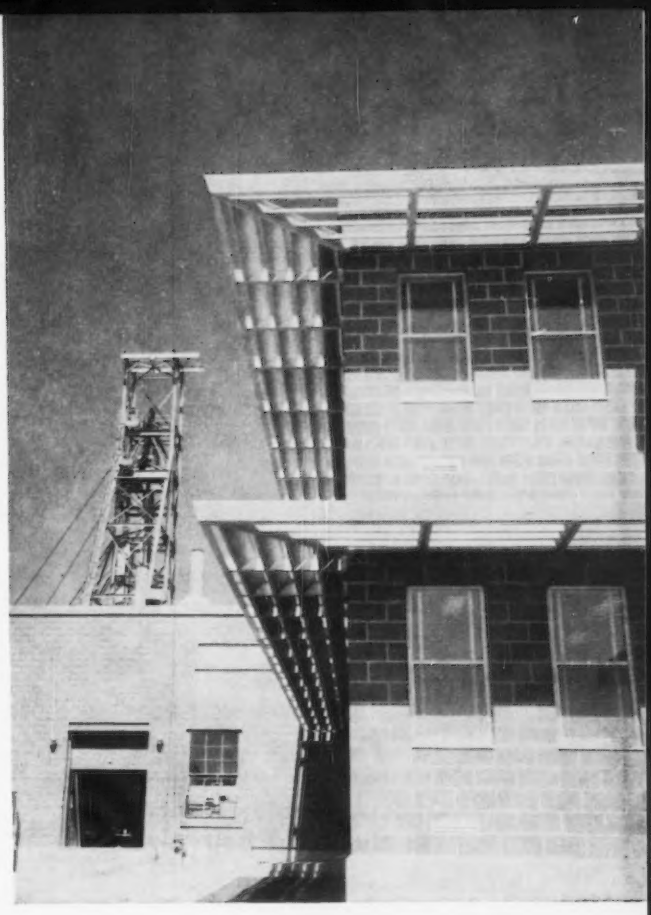
A Community Asset





Viburnum Project Starts Production

A. W. KNOERR

ST. JOSEPH LEAD CO.'S new Viburnum project in Southeastern Missouri, comprising three mines, a mill and townsite, which will ultimately cost some $20,000,000, is significant for a number of reasons:

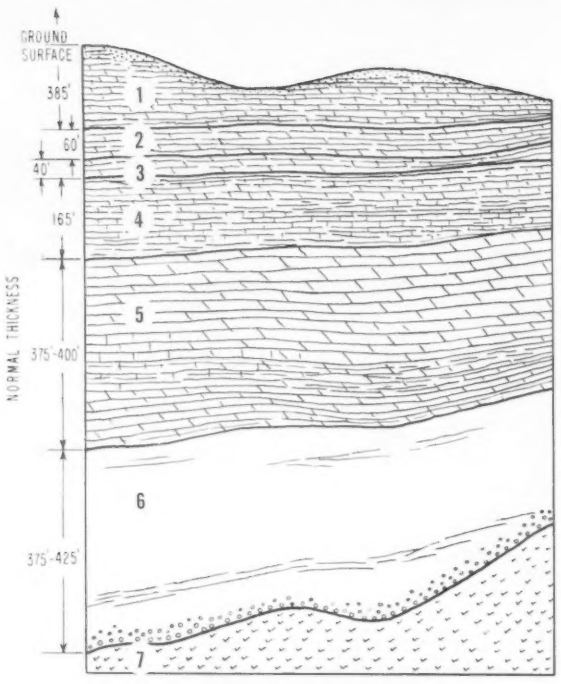
1. It's a distinct community asset. When completed, the project will provide a livelihood for workers, service people and their family members, numbering upwards of 2,000. The townsite will afford comfortable living through its shopping centers, recreation areas, lake, school and low-cost liberal-sized lots now being developed in an area that was somewhat of an univiting, undeveloped, crossroads wilderness. Architecturally, the attractive exteriors of offices and shops in combination with the clean, bold geometric forms of tubular conveyor galleries and massive cylindrical ore bins prove that industrial plants can indeed be blended into the landscape artistically and functionally. Without a doubt, the Viburnum surface plant is a showplace. Tailings are pumped to a dammed-up valley that will be converted into a lake offering good fishing—another community asset, which every miner appreciates.

2. The discovery of three substantial orebodies, that will eventually produce some 6,000 tpd near an old producing area such as the Lead Belt, is certainly a noteworthy event in the development of the domestic lead mining industry.

3. Technologically, Viburnum represents the very best in mining and milling that St. Joseph staff members have developed during a long history of constantly improving methods and equipment. Experience gained in the operation and development of older mines in the Lead Belt, plus the more recent modern mines and plants at Indian Creek and Hayden Creek, will make Viburnum one of the significant low-cost producers in the industry. Modern drilling and haulage equipment, coupled with the time-proven and productive St. Joe shovel loader, promise noteworthy efficiency in the mines. Automatic process controls and extensive and unique materials-handling facilities in the mill indicate that the push-button mill of tomorrow has arrived.

4. Programming of development and construction at Viburnum has been well timed. The mill is designed to house two 3,000-ton parallel strings of processing equipment. The current 3,000-ton plant will handle initial production from the No. 27 and 28 mines; the second 3,000-ton string will be installed when increased production from all three mines requires it.

Because some of the ore at all three mines will come from lands under lease from the Government, provisions have been made in the mine and mill to weigh and sample company ore and Government ore separately, and then blend them in the mill feed.



General Geologic Section in the Lead Belt Area

1. Potosi dolomite—drusy
2. Doe Run dolomite—massive and earthy
3. Derby dolomite—thin bedded with some shale
4. Davis shale—green shale, silty dolomite, limestone, sandstone, finely glauconitic
5. Bonne Terre dolomite—dolomite, shale and sandy dolomite, sometimes limestone
6. LaMotte sandstone—sandstone, shale, and some dolomitic sandstone residual igneous boulders at base
7. Pre-Cambrian igneous rock—granites, rhyolite porphyries, and felsites

Geology in Brief

ROCK FORMATIONS present in the Viburnum area are shown in the accompanying geologic section, typical of the Lead Belt. Ore occurs in the Bonne Terre dolomite in the form of irregular masses of disseminated sulphides, varying both in size and shape. Geophysical methods have not been successful in revealing the location of orebodies to date, possibly because of the low percentage of disseminated sulphides in the ore. Consequently, well-directed diamond drilling programs have been required to outline known orebodies.

Principal ore minerals include galena, lesser amounts of sphalerite and some copper minerals. Average lead content runs about 3 to 3.5%. The excellent metallurgy achieved at the mill to date is due to the absence of appreciable quantities of pyrite which cuts down the number and quantities of reagents required and simplifies the flotation circuit; and to the fact that sulphides can be liberated with a medium to coarse grind, which eliminates the need for regrind.

Orebodies near the No. 27 shaft occur roughly in two horizons, approximately 75 ft apart in elevation. This accounts for the two-level development program at the mine.

Ground water is present in sufficient quantity to require drainage and pumping, but it is not a major mining problem.

Scope of the Project

Major units of the Viburnum project include three mines situated near the junction of the boundaries of Crawford, Washington and Iron counties, approximately 35 miles southwest of the St. Joseph Lead Co.'s headquarters at Bonne Terre, Mo. Progress in the development and construction of these units is as follows:

1. No. 28 shaft and surface plant at Viburnum in Iron County. The main shaft and ventilation shaft have been sunk and development work for initial production is underway. At full capacity, ore production is scheduled to be about 2,000 tpd. Ore from the No. 28 shaft goes directly to bins, feeding the crushing plant and mill now equipped to process 3,000 tpd, with provisions for expansion to increase to 6,000 tpd when all three operating units achieve full capacity. As shown in accompanying plans, sections, flowsheets and photographs, other installations at the No. 28 unit include an office, change and hoist house, crushing plant, mill, garages, shops, warehouses, steel and pipe storage areas and a substation, which will serve all three operating units. A townsite, complete with shopping center, school and recreation area, is under construction north of the mill and office area.

2. No. 27 shaft and mine in Crawford County. Initial development work, including the main shaft, hoist and change house, and ventilation shaft, have been virtually completed, and ore production is being increased to the scheduled 2,000 tpd rate. Ore from this unit is shipped over a company-owned haulage road to the Viburnum mill at the No. 28 shaft.

3. No. 29 unit in Washington County. The ventilation shaft has been sunk and cased. Shaft sinking for the mine is scheduled for a later date. When in full production at 2,000 tpd, ore from this mine will be hauled to the Viburnum mill over a company-owned road.

Mine Development

When completed, each of the three mining units will be developed with a 12-ft 7-in. dia, concrete-lined main shaft and a 52-in. dia bored ventilation and auxiliary access shaft cased down to 46 in. Description of mining and development work will be confined to the No. 27 unit, because progress is most advanced at this property.

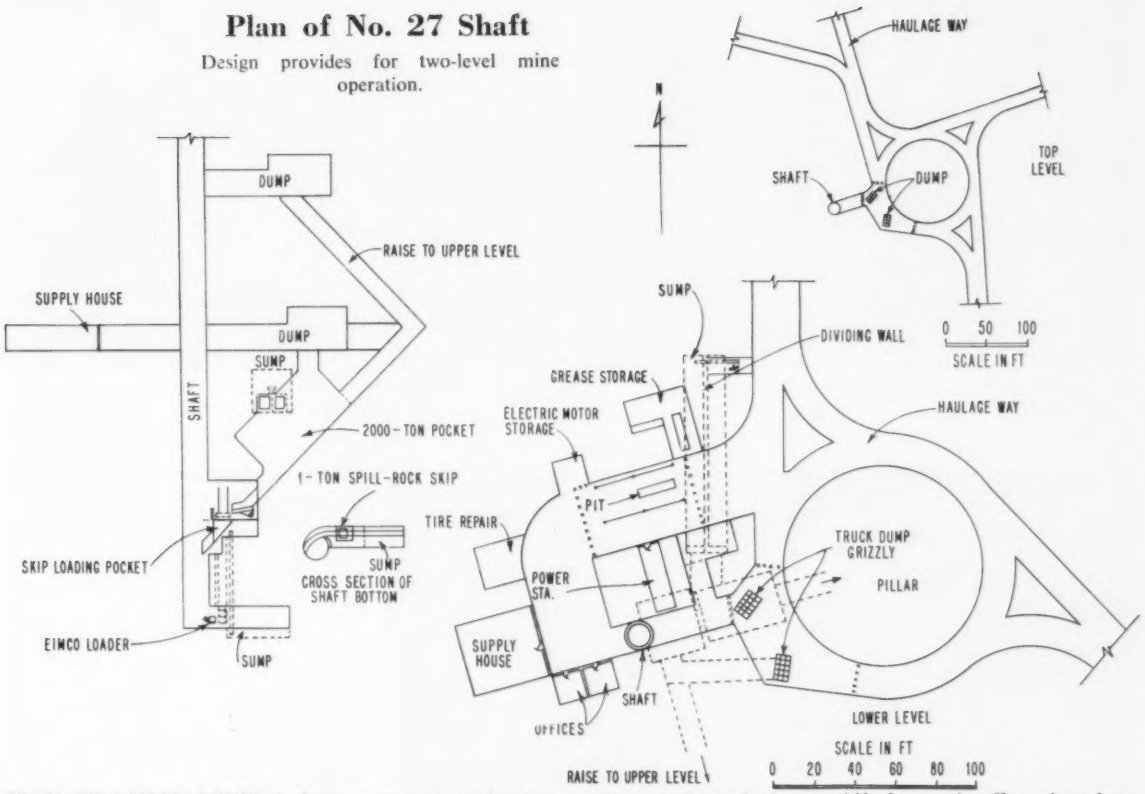
Details of the shaft installation and adjacent workings are shown on the accompanying illustration. A Nordberg cylindrical, single-drum hoist, powered by a 600-hp, ac, 2300-v induction motor, is equipped with Allen Bradley hoist controls. Hoisting ropes are 1⅝ in. in dia. Rope speed is 900 fpm.

Eight-ton, bottom dump skips, built by the company, are mounted below the cage, as shown on p 102. Steel guides are 90-lb rail. Details of the rubber-tire wheels, which move over the skip guides, are also shown on p 102, as well as the safety-dog mechanism.

Because of the disposition of the orebodies at the No. 27 unit, two-level development has been necessary. The interval between the two haulage levels is about 75 ft. See illustration. Ore from government-lease areas goes into a 2,000-ton pocket, and company-owned ore goes into a 3,000-ton pocket. Hewitt-Robbins 5x10 -ft vibrating feeders transfer the ore into a 12-ton measuring hopper equipped with a guillotine down-cut gate, operated by haudraulic controls. Since the skip capacity is 8-tons, a

Plan of No. 27 Shaft

Design provides for two-level mine operation.



PLAN OF LOWER LEVEL includes a general repair shop, underground supply house, shift foreman's office, shop foreman's office, tire repair shop equipped with a hydraulic tire changer, electric motor storage and grease storage.

cushion of four-tons of muck remains in the measuring pocket at all times. A three-inch steel step adjacent to the gate on the up slope of the hopper bottom assures a clean cut-off when the gate is closed.

The bottom of the shaft is equipped with an Eimco 21B rail-mounted loader to muck spillage into a small skip, which hoists the spillage to the 12-ton measuring hopper. A small deep-well pump handles drainage to the shaft bottom.

Three Peerless deepwell pumps, with capacity of 1,050 gpm against a 750-ft head, are installed above the main sump below the lower haulage level. See illustration. A concrete wall divides the sump longitudinally, so that either half can be cleaned when silt accumulates. A steel door at the shaft end of the sump can be opened to admit a small scraper, which will move the silt directly into an ore pocket.

Equipment used for development work and mining at the No. 27 unit is listed in the accompanying table.

Because of the irregular disposition of the orebody, a casual room and pillar system is employed, by which pillars can be left in waste rock as much as possible. Details of a typical shatter-cut round are shown in the accompanying illustration. Two drillers operate the jumbo. Three 3-in. burn-cut holes and centrally located 1⅜-in. holes are drilled by one man operating the middle drill. The other driller runs the two side drills. Remote controls permit operation of two drills at once. Drillers charge and shoot their own rounds, and are responsible for dressing the back and face.

Hercomite 7A, about 20% strength, is loaded into the cut holes, and Gelamite No. 1, 60%, is used in remaining holes. P-38 caps which give a longer delay than ordinary millisecond delays give more concise control of blasting. The combination of the burn-cut, plus properly-timed delays, keeps the muck at the face. In former rounds of the size described, equipment had to be moved 200 to 300 ft from the face to prevent damage from fly-rock. Now it can be kept 50 to 60 ft from the face with safety.

Development rock is loaded with a Transloader at the No. 27 unit. St. Joe shovels equipped with ½-yd buckets load the ore. Maximum capacity of a St. Joe shovel is about 500 tons per shift; average yields about 350 tons per shift, operating with two trucks on hauls up to 4,000 ft. The company has 52 St. Joe shovels in the Southeast Missouri District, and they are so rugged and dependable that the newest one is 31 years old.

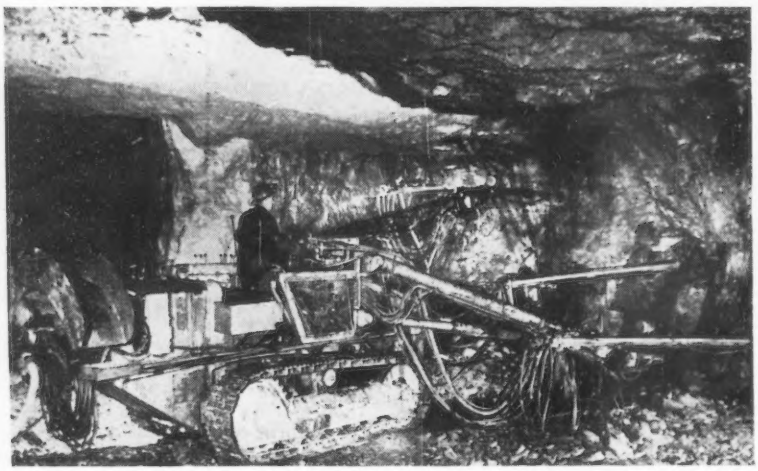
Two 10-ton Cline trucks operate

Mine equipment in use at the No. 27 shaft unit.

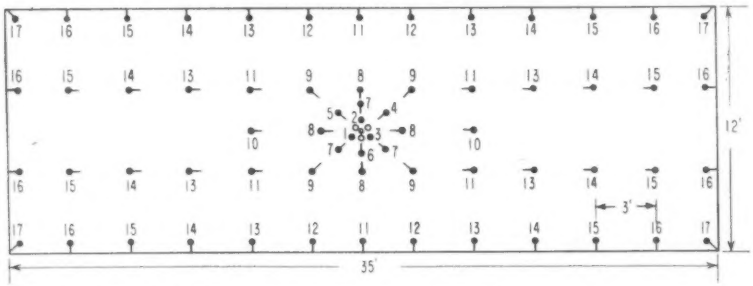
- 4 Gardner-Denver jumbos, 1 in development and 3 on production.
- 4 St. Joe shovel loaders, 3 operating one spare.
- 1 Transloader on development.
- 2 Jackleg drills to break ore where jumbo can't reach.
- 9 10-ton Cline diesel-powered trucks for haulage.
- Motorgrader for road maintenance.
- Repair truck equipped with crane for maintenance.
- Truck-mounted "giraffe" or aerial platform. Pittman Mfg. Co. Will reach to 40 ft. to be used for mining and trimming high backs.
- 1 Ford farm tractor and fork-lift for charging top holes in jumbo rounds. Platform goes to 16 ft, hence man can easily work to 20-ft back.

ST. JOE SHOVEL, equipped with ½-yd buckets, loads a 10-ton diesel-powered, low-build truck at typical mine face.

TRANSLOADER will travel at 15 mph with a 6-ton payload. Maximum efficient haul is estimated to be about 2,500 ft.



THREE-MACHINE DRILL JUMBO is operated by two drillers. One man runs the center drill, while the other miner operates the two outside machines.



SHATTER-CUT DRILL ROUND at Viburnum operations. The number at each hole indicates the electric cap delay number. Holes 1, 2 and 3 are charged all the way to the collar with Hercomite 7A, tamping the last stick only. Holes 4 through 7 are charged all the way to the collar with Gelamite No. 1 and are tamped lightly. The rest of the holes are charged about two-thirds full of Gelamite No. 1, and are heavily tamped.

with a loader. Minimum height of working space is 8 ft. Units are powered with four-cycle GM diesel engines, approximately 100 hp. Dimensions of the trucks are: height, 66 in. to top of loading bed, width, 8½ ft; length, 20 ft. All trucks are equipped with St. Joe scrubbers, in which gas is cleaned as it passes through tubes in a water bath. Two critical requirements to safe operation of diesel-powered equipment are keeping motors well tuned, and providing adequate ventilation. St. Joe's Industrial Hygiene Department takes samples of mine air and diesel exhaust regularly. When a sample indicates poor exhaust conditions, maintenance crews repair and adjust the diesel engines. Maximum haulage speed is 15 mph. The mine is planned for low haulage grades, but some go to 12% because of irregularity of the orebodies.

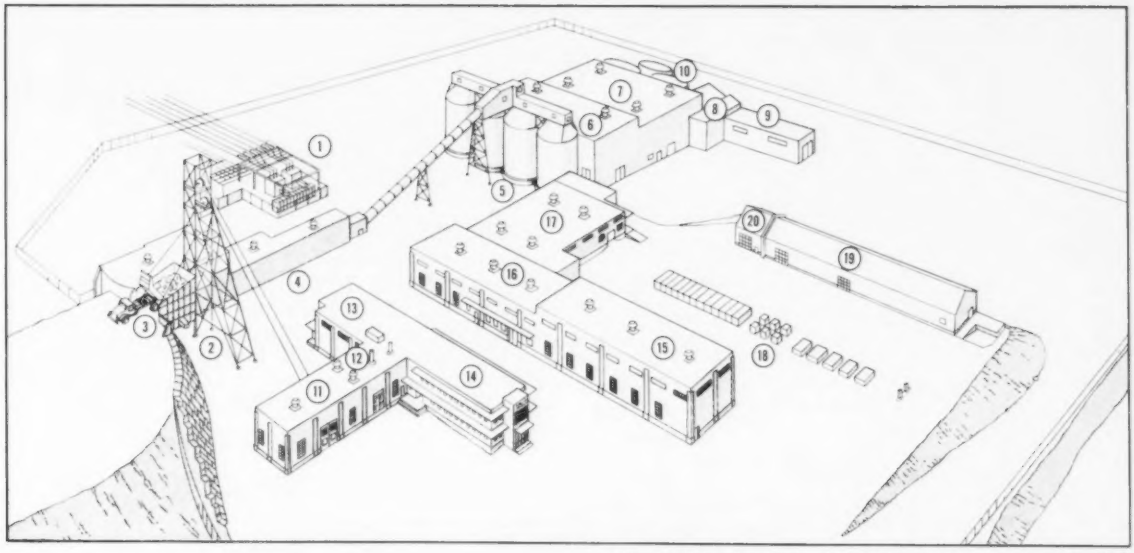
One truck driver operates two trucks, driving one to the shaft dump while the other is being loaded. The shovel can load a truck in about seven minutes. Two trucks with one driver can keep the shovel loading continuously with a haul of 4000 ft one way. Accurate records are kept of haulage by requiring each truck driver to punch a time clock at the shaft pocket each time he dumps a load. This information will be useful in planning and timing mining cycles in the future.

The Transloader will travel at 15 mph with a 6-ton load. Maximum efficient haul appears to be about 2,500 ft. The No. 28 mine will have all Transloader haulage.

A spiral haulageway near the No. 27 shaft, connecting the two operating levels, is driven on a 12% grade. Its main use is to transport equipment.

Ventilation

Ventilation shafts, 52 in. in dia, at each of the mine units have been put down with rotary drills fitted with Hughes roller bits. Kuehn & Roberts of Abilene, Texas, was the shaft-sinking contractor. The 600-ft shaft at No. 27 was started with coring equipment, but this was later changed



Plant design by General Engineering Co. of Canada, Ltd.

Buildings at Viburnum Surface

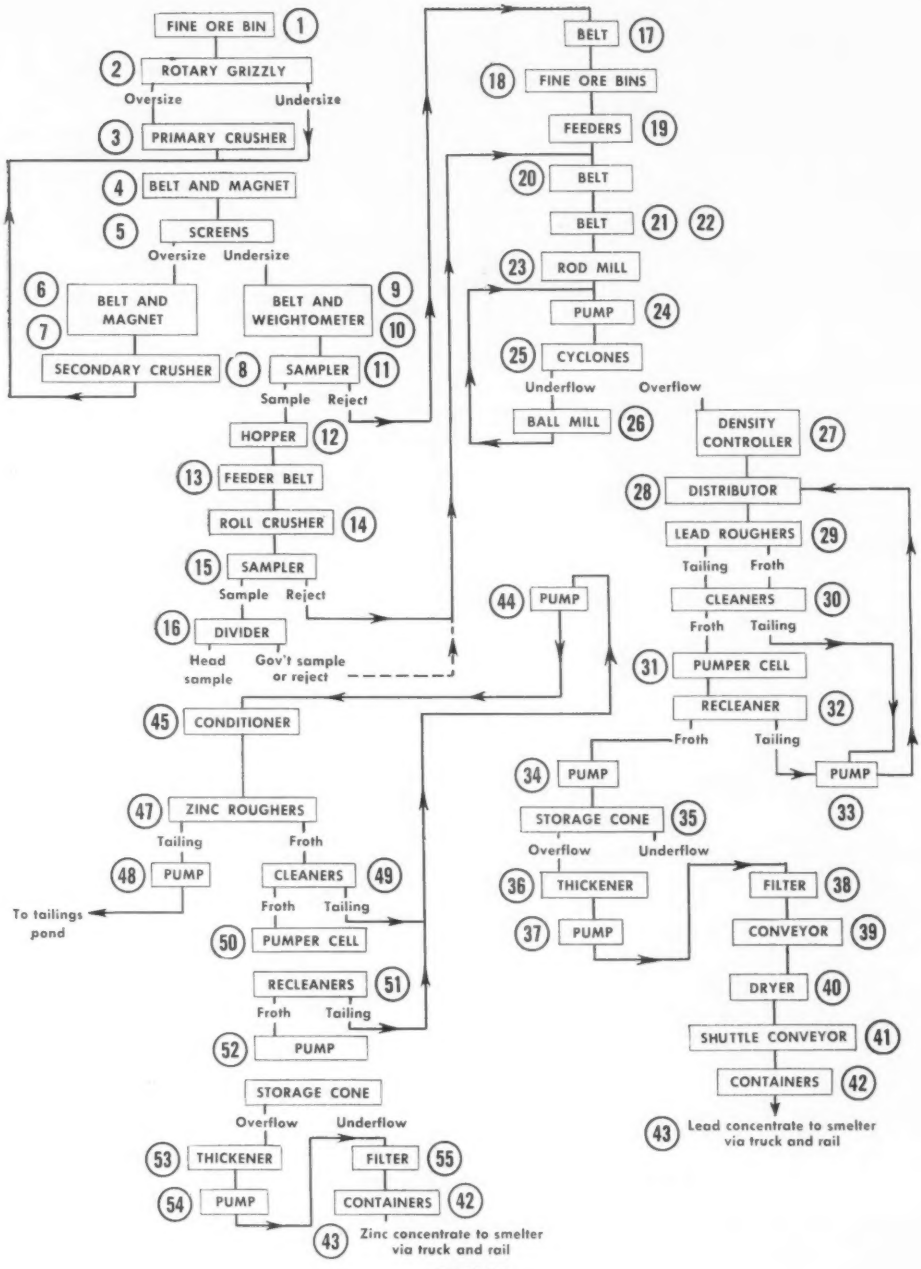
1. Substation. Power will be transmitted over company lines from here to No. 27 and 29 units at 34,500 v
2. No. 28 shaft and headframe
3. Receiving bin for ore hauled from the No. 27 and 29 shafts
4. Primary and secondary crushing plant
5. Fine-ore bins (only two completed to date, also one waste-rock bin)
6. Grinding and classification section of the mill
7. Flotation and filtration section
8. Drying plant
9. Concentrate storage and loading
10. Thickeners (Only two installed to date)
11. Compressor and hoist house
12. Boilers and control room
13. Change rooms
14. Office
15. Repair garages
16. Mechanical and electrical shops
17. Warehouse
18. Steel, pipe and plate storage
19. Storage building
20. Grease and oil storage

to a boring unit holding 14 roller bits with varying teeth construction. It took 60 days to drill the 730-ft No. 28 shaft with non-coring equipment. Depth of the No. 29 ventilation shaft, which is steel-cased, is 450 ft.

Underground installed Aerodyne fans, powered by 25-hp motors, will downcast ventilation air for the mines. Main shafts will be upcast to prevent the shaft from freezing during cold weather. Auxiliary blowers will be installed underground to maintain good circulation. Two churn-drill holes at the No. 27 mine will provide

Flowsheet of the Viburnum Lead-Zinc Flotation Mill

St. Joseph Lead Co., Viburnum, Missouri



LEGEND

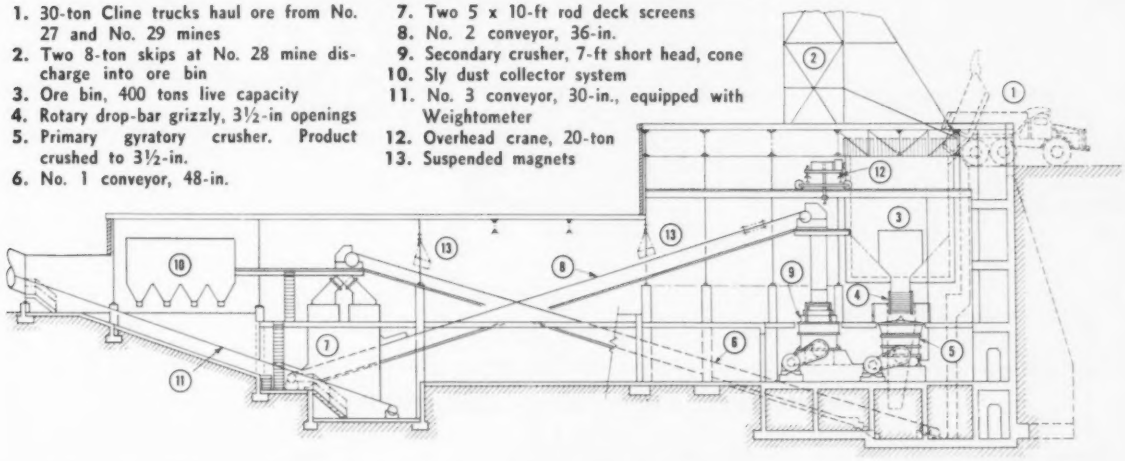
1. Mine ore bin, live capacity 400 tons
2. Rotary drop-bar grizzly, St. Joe make, 5 ft dia. Oversize, 3½ in.
3. Primary crusher, Telsmith 25-B, powered by 2300-v, 150-hp motor. Product is crushed to 3½ in.
4. No. 1 conveyor, (Note all belts identified in this flowsheet are Chain Belt-Goodrich units.) 48-in.
5. Two Nordberg, 5x10-ft rod deck vibratory screens. Oversize, +⅝ in.
6. No. 2 conveyor, 36-in.
7. Magnetic Engineering & Manufacturing Co. magnet
8. Secondary crusher, Nordberg Symons Shorthead powered by 2300-v, 300-hp motor. Product is crushed to ⅝ in.
9. Merrick Weightometer
10. No. 3 belt, 36-in.
11. Denver sample cutter, 0.043% sample retained
12. Hopper 1-ton
13. Feeder belt
14. Roll crusher, Denver 16-in. x 10-in. face
15. Denver sampler, 2.8% sample retained
16. Divider. Final split is 0.000301% of mill feed
17. Reversible cross-belt over fine ore bins, 42-in.
18. Two 3,300-ton circular fine-ore bins
19. Four feed belts 30-in.
20. Two 24-in. cross conveyors
21. Feed belt to No. 1 rod mill, 30-in.
22. Trans-Weigh unit to measure and control feed to rod mill
23. Rod mill, Allis-Chalmers, 10-ft 6-in.

THIRTY-TON TRUCK picks up load at the No. 27 shaft which is hauled over a 4-mile company road to the Viburnum mill.

SAME TRUCK discharges its load in the receiving ore bin, which feeds the crushing plant at the Viburnum No. 28 shaft.

Crushing Plant at No. 28 Mine

1. 30-ton Cline trucks haul ore from No. 27 and No. 29 mines
2. Two 8-ton skips at No. 28 mine discharge into ore bin
3. Ore bin, 400 tons live capacity
4. Rotary drop-bar grizzly, 3½-in openings
5. Primary gyratory crusher. Product crushed to 3½-in.
6. No. 1 conveyor, 48-in.
7. Two 5 x 10-ft rod deck screens
8. No. 2 conveyor, 36-in.
9. Secondary crusher, 7-ft short head, cone
10. Sly dust collector system
11. No. 3 conveyor, 30-in., equipped with Weightometer
12. Overhead crane, 20-ton
13. Suspended magnets



additional ventilation. When completed, the circular ventilation shafts will be equipped with circular cages for inspection and emergency exit.

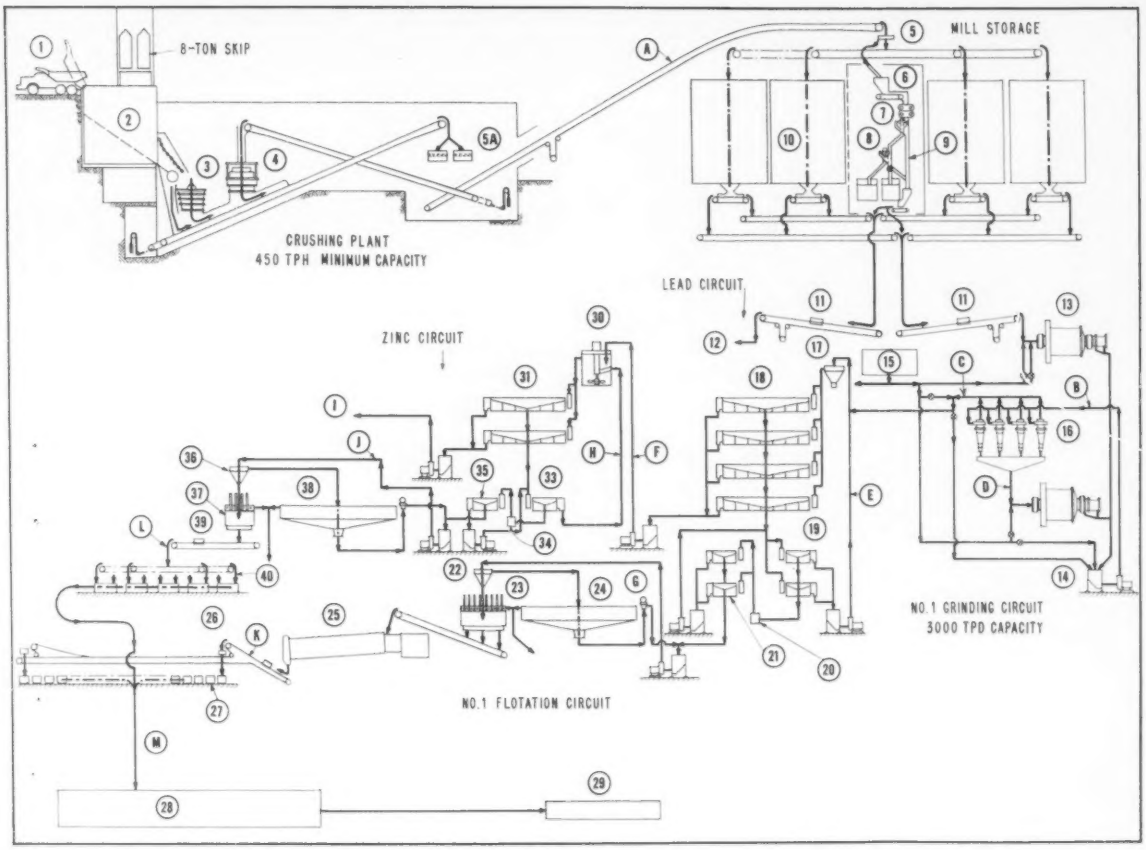
Surface plant installations at the No. 27 mine include a hoist house, compressor room equipped with a Joy twin semi-radial 600-hp unit with capacity of 3160 cfm, changehouse, transformer station and offices for mine personnel, and a 400-ton ore bin at the shaft.

Surface Haulage

A main haulage road, approximately four miles long, connects the No. 27 unit with the mill at the No. 28 unit. The haulage road is constructed with a 2- to 3-ft base of

x 14 ft; 700-hp, 2300-v synchronous motor. Unit equipped with Farval lubrication system

24. Pettibone Mulliken 8 MO 24 pump to cyclones, equipped with controls to maintain constant head to pump and constant feed to cyclones
25. Four Krebs D20L cyclones. Underflow—6-mesh, 75% + 100-mesh. Overflow to flotation, 2% to 3% on 48-mesh, 50%—200-mesh. 47-50% solids
26. Ball mill, Allis-Chalmers, 12 x 12-ft, equipped with 800-hp, 2300-v synchronous motor and Farval lubrication system
27. Ohmart gamma-ray density controller
28. Four-way distributor. Cyclone overflow of 47-50% solids is reduced to 35-38% solids for flotation roughers by controlling spray water in the rougher and cleaner launders which is pumped back to the distributor in the cleaner tails.
29. Lead roughers. Four banks of 7-cell Wemco Fagergrens, 66 x 60-in.
30. Lead cleaners. Two banks of 2-cell Wemco Fagergrens, 66 x 60-in.
31. Wemco pumper feed cell, at head of each recleaner unit
32. Recleaners. Two banks of 2-cell Wemco/Fagergrens, 66 x 50-in.
33. Tailings pump, Denver 5 x 5-in. SRL
34. Lead concentrate pump
35. Two 13 x 14-ft storage cones
36. St. Joe thickener, 50-ft dia
37. Thickener underflow pump, Denver 3 x 3-in. SRL
38. Filter, Eimco 8-disk, 10-ft 6-in. dia
39. Conveyor to dryer, 24-in.
40. Dryer. American Transportation Co. 7 x 40 ft, propane-gas fired, rotary furnace, equipped with dust control system by Lehigh Fan & Blower Div., Fuller Co.
41. Lead concentrate shuttle conveyor and Trans-Weigh unit to set weight for each concentrate shipping bucket to be loaded
42. Concentrate shipping container, Missouri-Pacific RR., 9-ton capacity
43. Concentrates are trucked over 39-mile haul to railhead by Cline diesel tractor and trailer, 18 tons hauled per load
44. Pump to zinc circuit conditioner, 10 x 8-in. Denver SRL
45. Conditioner, 9 ft 2⅝-in. x 14-ft deep, Wemco closed type
47. Zinc roughers. Twelve 66 x 60-in. Wemco Fagergrens
48. St. Joe 10 x 8-in. centrifugal pump in series with an identical unit
49. Zinc cleaners. Two 66 x 60-in. Wemco Fagergrens
50. Wemco pumper cell ahead of recleaners
51. Zinc recleaners. One Wemco Fagergren 66 x 50-in.
52. Pump to storage cone, 3 x 3-in. Denver SRL
53. Thickener, size 40 ft, St. Joe make
54. Pump to filter Denver 3 x 3-in SRL
55. Zinc concentrate filter, 10-ft 6-in. dia x 8-disk



Mechanical Flowsheet, Viburnum Mill

1. 30-ton trucks
2. 400-ton ore bin
3. Gyratory crusher
4. 7-ft shorthead cone crusher
5. Sampler, 5 tons per 24 hr

5A. 5x10-ft rod deck screens

6. 8-ton ore bin
7. Crushing rolls
8. Vezin samplers
9. Reject chute
10. 3300-ton fine ore bins
11. Weighing device for controlled feed to rod mill
12. No. 2 grinding circuit, future installation
13. Rod mill, 10-ft 6-in. x 14-ft
14. Centrifugal pump
15. Water supply, constant pressure
16. Cyclone classifiers
17. Four-way splitters
18. Lead roughers for 3,000-tpd capacity, 28 No. 66 Fagergren cells
19. Lead cleaners, four No. 66 Fagergren cells
20. Pumper cell to recleaners
21. Lead recleaners, four No. 66 Fagergrens
22. Dewatering cone
23. Disk filter, 10-ft 6-in., 9-disk
24. Thickener, 50 ft dia x 8 ft high
25. Lead concentrate dryer
26. Weighing device for automatic loading of lead concentrate containers
27. 9-ton concentrate buckets
28. Concentrate loading and storage capacity, 680 tons
29. Trailers carry load to railhead
30. Zinc conditioner, 9-ft 2-in. x 14 ft
31. Zinc roughers, 12 No. 66 Fagergren cells
32. Pumps to tailing disposal line
33. Zinc cleaners, two No. 66 Fagergren cells
34. Pumper cell to zinc recleaners
35. Zinc recleaner, one No. 66 Fagergren cell
36. Dewatering cone
37. Filter, 8-ft 10-in. x 4-disk
38. Thickener, 40-ft dia x 8-ft high
39. Weighing device
40. Concentrate loading system, same as for No.'s 26, 27, 28, and 29 above

Mill Product or Feed Materials

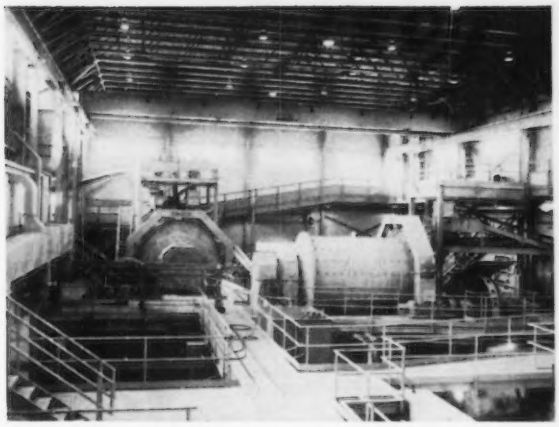
A. Fine ore crushed to 5/8-in.
B. Cyclone feed
C. Cyclone overflow
D. Cyclone underflow
E. Cleaner tailing
F. Lead rougher tailing to zinc circuit
G. Lead concentrates
H. Zinc cleaner tailing
I. Zinc rougher tailing to pond
J. Zinc concentrate to filter
K. Dried lead concentrates
L. Filtered zinc concentrates
M. Concentrates to storage

mine-run rock, covered with 6 in. of gravel and oiled to keep down dust and provide a better surface. Width is 35 ft; maximum grade, 4.6%. A branch from this road will lead to the No. 29 shaft in the future. This haul will also be about four miles.

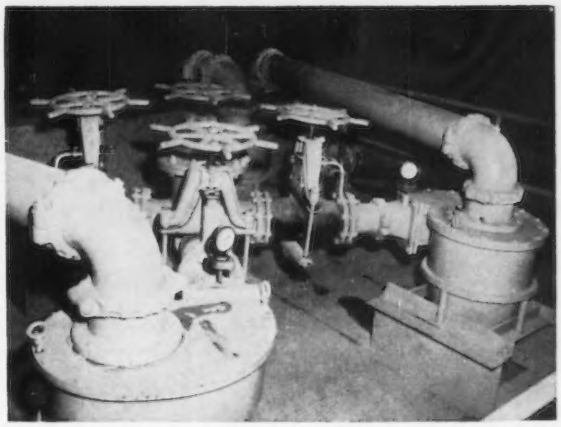
Thirty-ton Cline trucks on the surface haul are equipped with automatic transmission, hydraulic starting. A large mirror at the driver's left enables him to spot a truck and observe the loading gate of the ore bin. A small radio control in the cab opens and closes the loading gate. See operating ideas, p. 104.

Mill Highlights

Accompanying annotated flowsheets, plans and sections depict the process used to produce lead and zinc concentrates at Viburnum and identify the size and type of important equipment. Consequently, the following



ROD MILL (right) and ball mill (left) with cyclone classifiers, above, comprise the grinding and classification section.

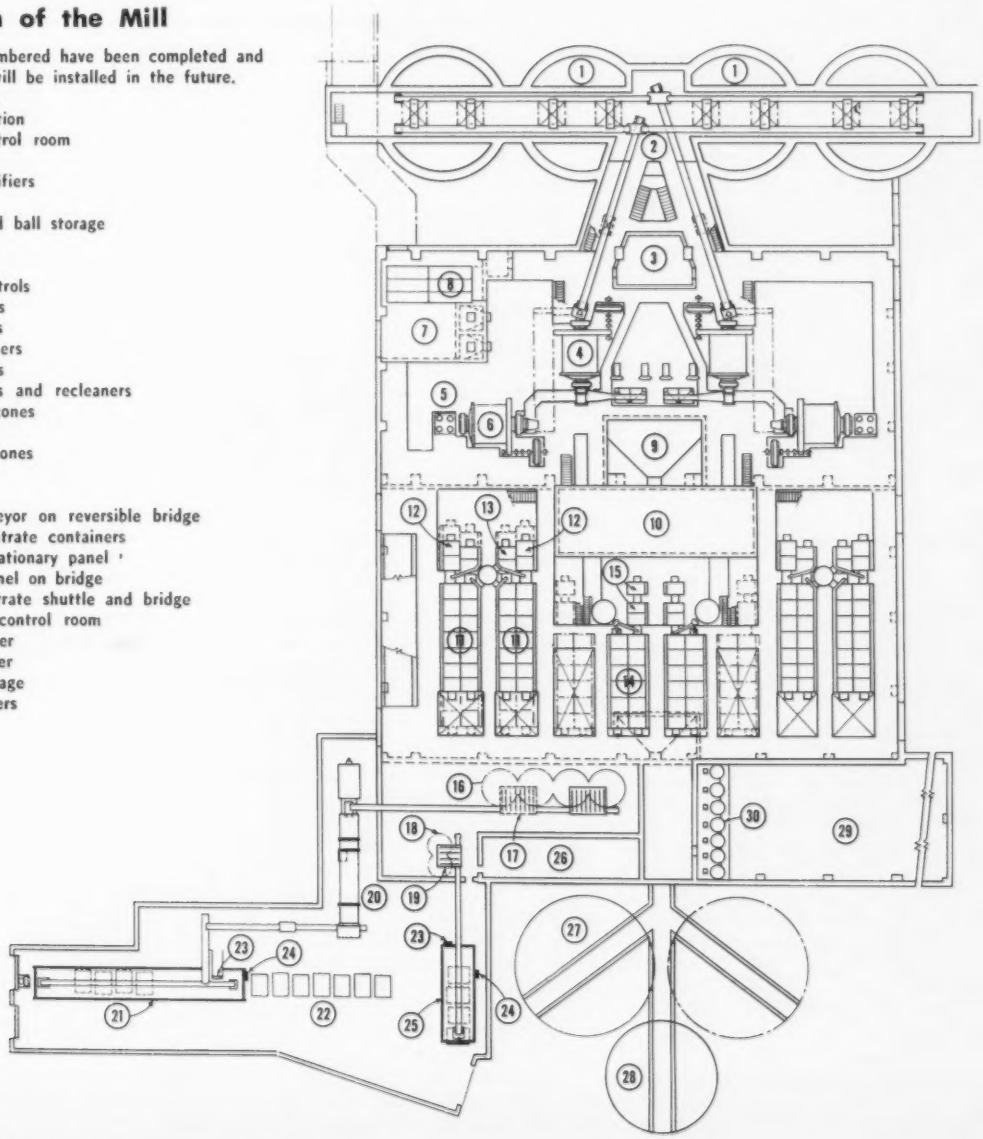


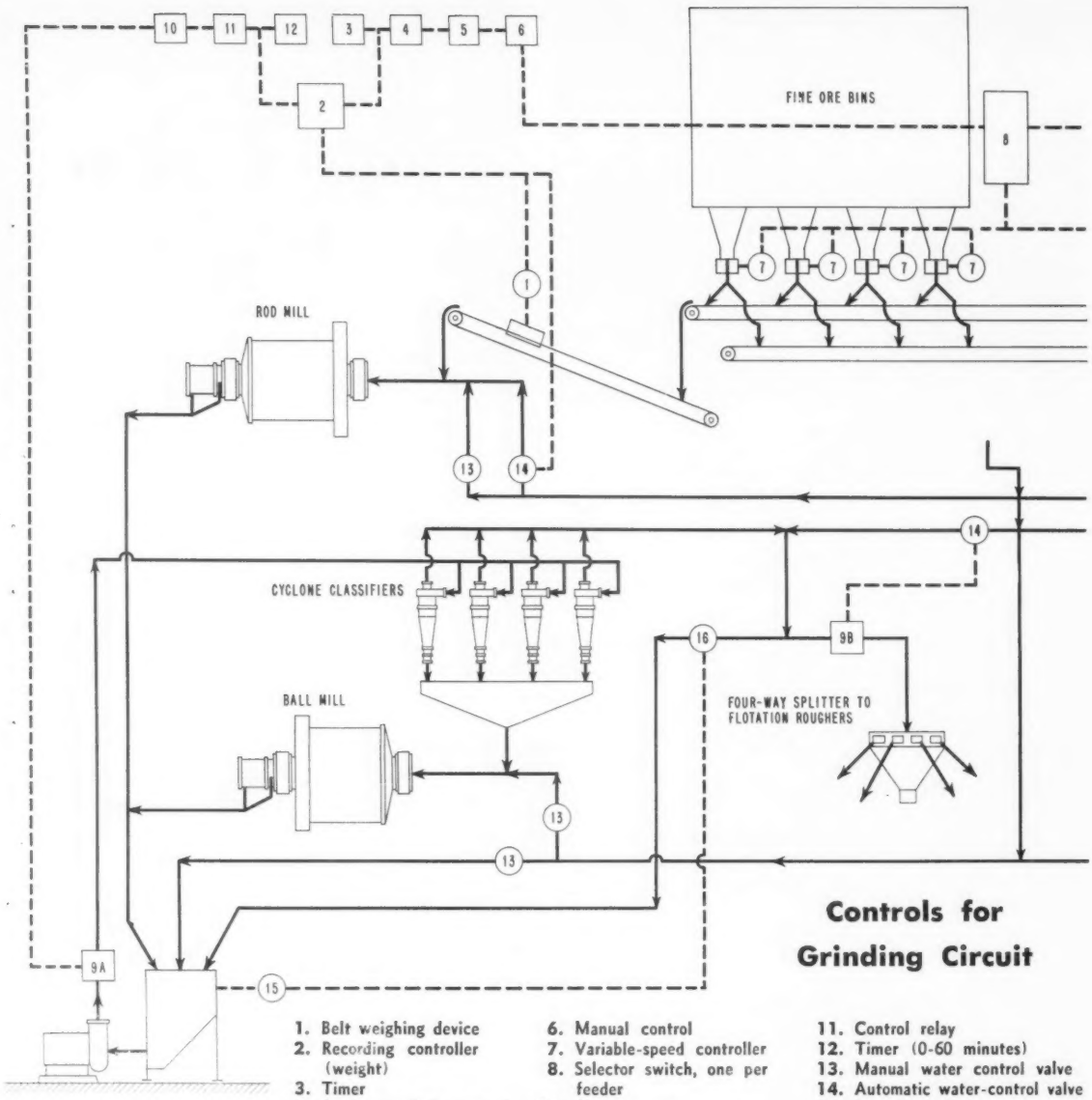
FOUR CYCLONES receive feed from a common line. This system prevents units from robbing feed and unbalancing product.

Plan of the Mill

Note: Items numbered have been completed and installed. Others will be installed in the future.

1. Fine ore bins
2. Crushing section
3. Grinding control room
4. Rod mill
5. Cyclone classifiers
6. Ball mill
7. Truckway and ball storage
8. Rod storage
9. Floor sump
10. Flotation controls
11. Lead roughers
12. Lead cleaners
13. Lead recleaners
14. Zinc roughers
15. Zinc cleaners and recleaners
16. Dewatering cones
17. Lead filter
18. Dewatering cones
19. Zinc filter
20. Drying kiln
21. Shuttle conveyor on reversible bridge
22. 9-ton concentrate containers
23. Operator's stationary panel
24. Relay sub-panel on bridge
25. Zinc concentrate shuttle and bridge
26. Switch and control room
27. Lead thickener
28. Zinc thickener
29. Reagent storage
30. Reagent mixers





Controls for Grinding Circuit

1. Belt weighing device
2. Recording controller (weight)
3. Timer
4. Selector switch, manual or automatic
5. Control relay
6. Manual control
7. Variable-speed controller
8. Selector switch, one per feeder
9A. Density gage
9B. Density gage
10. Density recording controller
11. Control relay
12. Timer (0-60 minutes)
13. Manual water control valve
14. Automatic water-control valve
15. Level controller
16. By-pass control valve

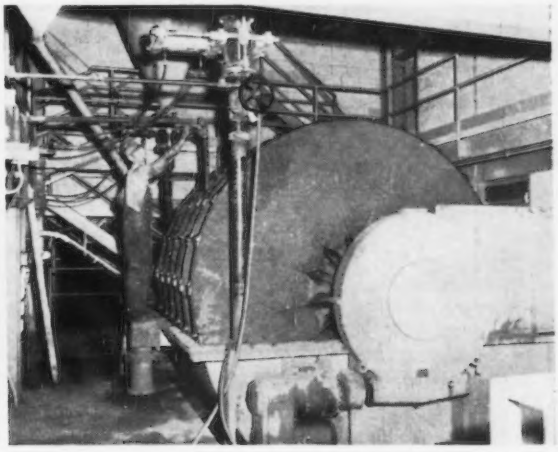
comments are confined to the unusual aspects of the plant and process.

Materials handling facilities at the mill are described as "unique" by visiting metallurgists. Success of the system is due to planning, which in part incorporated all advanced techniques developed at the Hayden Creek and Indian Creek plants of St. Joe, plus consultation with warehouse keepers, supervisors and operators who contributed many practical effort-saving ideas used in the final design. An outstanding feature is the concrete ramp and travelway system that permits transport of equipment, supplies and parts to all operating levels and decks by rubber-tired, fork-lift truck. Overhead cranes, as shown in accompanying mill sections, maneuver supplies to final position with a minimum of manual effort. The ramp system connects to the main warehouse, which is centrally situated in the surface plant area, and also to receiving areas in the mill, where supplies can be unloaded directly from trucks. A rod charging device similar to that used at other St. Joe mills is installed at the discharge end of the rod mill. Balls are transported in a special hopper by crane to a small steel platform near the feed end of the ball mill. (See operating ideas p 104) As the crane sets the hopper on this platform, relaxed tension in the hoist rope permits a trap at the bottom of the hopper to discharge balls through a hole in the floor of the platform to the ball mill feed. Reagents are stored and mixed in an area on the lowest floor of the mill (see plan). Concrete reagent mixing cells are built below floor level so that the reagents can be discharged into them easily. Stainless-steel, propeller-type reagents mixers with overhead motors are mounted in the rear of the concrete cells. Mixed reagents are discharged by gravity to motor-pumps, which feed the reagent feed

FOUR CONTINUOUS RECORDERS in grinding control room monitor rod-mill feed rate, recirculation load, flotation feed density, and water valve position. Fred Scott is the operator.

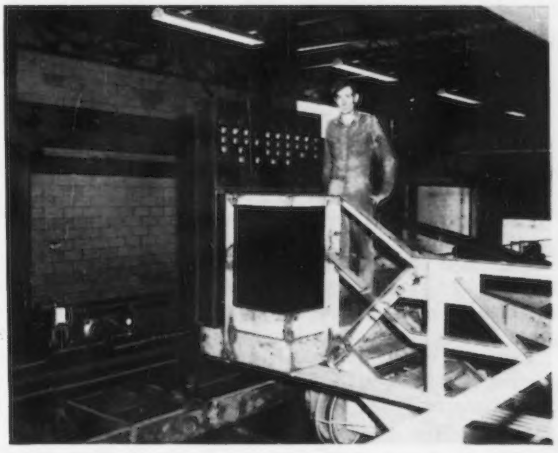
GAMMA-RAY INSTRUMENT continually measures pulp density of cyclone overflow on its way to the flotation circuit. Orville Furry, flotation operator, shows a check weigher.

TABLE-TOP PANEL in flotation control room governs operation of roughers, concentration pumps, lead pumper feed box, lead cleaners, lead recleaners. Zinc controls are in foreground.

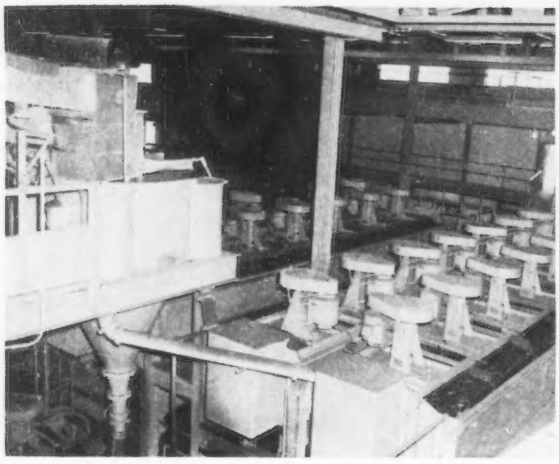


AUTOMATIC VALVE at top of pipeline controls flow of concentrate slurry to filter to maintain exact pulp level for efficient filtering. A. L. Barton is the filter operator.

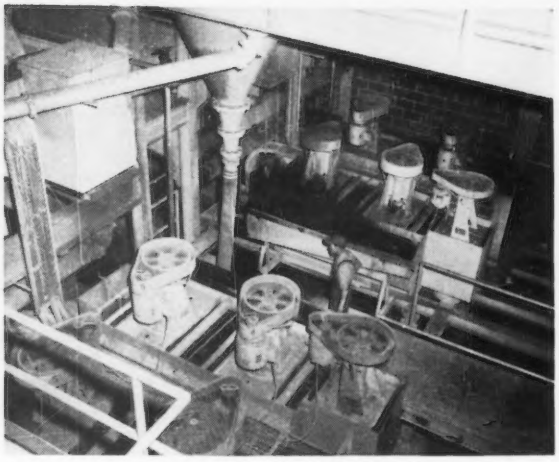
AUTOMATIC WEIGHING DEVICES on the conveyor belts weigh dry concentrates delivered from the filter plant to the shipping room. Recorders, above, keep track of weights.



PUSH-BUTTON PANEL controls automatic shuttle conveyor which loads concentrates into shipping containers. Robert Duncan is the operator of the automatic loading equipment.



DISTRIBUTOR at the head of the lead flotation section feeds four banks of Fagergren 66x66-in. 7-cell roughers.

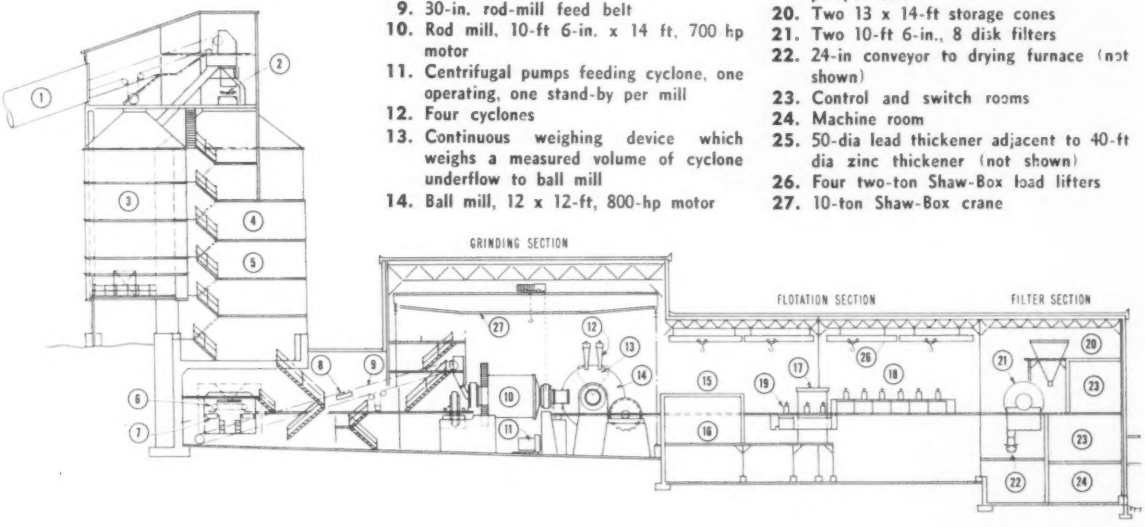


FOUR CLEANER CELLS on the outside feed four recleaner cells adjacent to the walkway through pumper cells at right.

Legend for Longitudinal Section Through Mill

Note: All equipment items are fully designated and described in legend to flowsheet.

1. 36-in. conveyor
2. 42-in. reversible cross-belt feeder to bins
3. Crushed waste bin
4. Two fine-ore storage bins, 3300-ton live capacity
5. Sampling plant between two fine-ore bins
6. Two 30-in. feed belts per bin
7. 24-in. cross conveyor
8. Weighing device
9. 30-in. rod-mill feed belt
10. Rod mill, 10-ft 6-in. x 14 ft, 700 hp motor
11. Centrifugal pumps feeding cyclone, one operating, one stand-by per mill
12. Four cyclones
13. Continuous weighing device which weighs a measured volume of cyclone underflow to ball mill
14. Ball mill, 12 x 12-ft, 800-hp motor
15. Flotation operator's control floor
16. Control and switch room
17. Zinc conditioner, 9 ft 2⅝-in. by 14 ft
18. Two banks of 14-cell lead roughers
19. Two two-cell lead cleaners; and two two-cell recleaners each equipped with pumper cell
20. Two 13 x 14-ft storage cones
21. Two 10-ft 6-in., 8 disk filters
22. 24-in conveyor to drying furnace (not shown)
23. Control and switch rooms
24. Machine room
25. 50-dia lead thickener adjacent to 40-ft dia zinc thickener (not shown)
26. Four two-ton Shaw-Box load lifters
27. 10-ton Shaw-Box crane



tanks above the flotation deck. Automatic float devices in these tanks control the operation of the motorpumps in the mixing room. Stainless-steel reagent feed tanks discharge to stainless-steel Clarkson reagent feeders mounted on a bench near the control room for the flotation section.

Extensive use of automatic process controls contribute to the high efficiency and metallurgical recovery at the Viburnum mill. Note in the accompanying flowsheet of controls in the grinding and classification circuits how extensively interlocked controls are employed. Control stations or enclosed control rooms have been installed in strategic positions in the crushing plant, grinding and classification section, flotation section, filter and concentrate drying area, and on the concentrate loading unit.

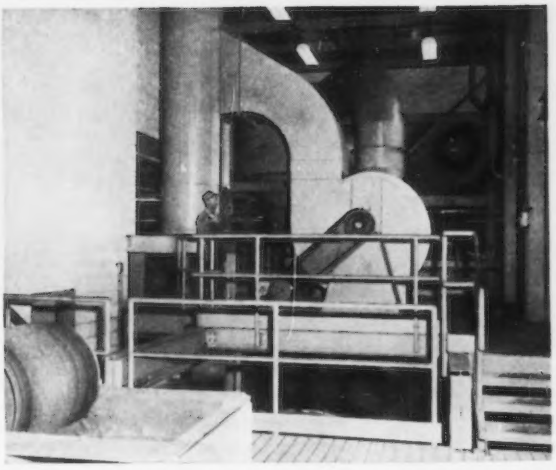
Management opinion at St. Joe is that automatic controls must do at least one of four things: (1) save labor, (2) safeguard equipment, (3) improve metallurgy, or (4) keep equipment loaded to capacity.

In some instances automatic controls are superfluous. For instance, the little periodic effort required to pump the handle on the Farval lubrication systems on the ball and rod mill eliminates the need for automatic controls on these units. This, of course, means that the operator must take routine trips to inspect equipment and maintain steady lubrication, which is a normal function.

Noteworthy highlights in the control system are as follows:

1. In the crushing plant an intercom system tells the operator about the source of ore being crushed—i.e. whether it is government or company ore from the No. 27, 28 or 29 shaft. Tonnage is recorded accurately as to source through a Weightometer in-

STAINLESS- STEEL reagent tanks feed a row of stainless-steel Clarkson reagent feeders on operator's deck of the mill.



BLOWERS installed above the 7x40-ft, gas-fired, rotary lead concentrate dryer remove dust from the discharge end of dryer.

stalled on a conveyor in the plant.

2. A Transweigh unit enables the grinding operator to maintain desired feed rate to the ball mill. Push buttons on the panels in the control room can be set to blend ores from the various fine-ore bins in desired proportions. Feed rate to the rod mills is automatically controlled by devices which measure the circulating load on cyclone underflow, also the pulp density of feed to the flotation circuit.

3. A pulp-level control on the intake end of cyclone feed pumps insures a constant rate of feed to the cyclones. This is critical to good cyclone operation.

4. A weighing device on the cyclone underflow continually weighs the circulating load passing through a steel box of measured volume mounted on floating steel levels. (See operating idea p 104)

5. A gamma-ray pulp density measuring unit monitors cyclone overflow continuously. An automatic valve adjusts the addition of water to the cyclone feed to maintain desired pulp density through the cyclone. This is critical to good cyclone operation.

6. A float control, operating a pinch valve on the cone discharge to Eimco filters, maintains the correct level of concentrate slurry in the filter.

7. A Transweigh unit on the shuttle conveyor loading concentrate buckets records the tonnage of dry concentrates loaded out. Controls also measure exactly nine tons for each shipping bucket and move the discharge point of the loader to an empty bucket, as each previous bucket in the line is filled. (See illustration and plan.)

Metallurgical objectives. [1]In working out the flowsheet for the Viburnum project, St. Joe metallurgists fixed first on a grade of concentrate that would be economic for smelting, and then sought the coarsest grind that would respond to flotation to give the desired grade and maximum recovery. The resulting flowsheet is direct, relatively simple, and capable of adjustment to accommodate changing mill feed. Physically, the plant uses gravity to develop smooth process flow-through. See accompanying mill section. The following sizes, pulp densities and grades are approximately those used during initial operations:

Ore: Chiefly galena disseminated in dolomite with minor quantities of zinc and copper sulphides. Grade runs about 3 to 3.5%.

Primary crusher: Feed is plus 3½-in., product is reduced to 3½-in.

Secondary crusher: Feed is 3½-in., product is reduced to minus ⅝-in.

Grinding circuit: Ore is ground to 57% minus 200-mesh, and 4% plus 48-mesh.

Cyclone products: Underflow is 75% minus 6-mesh, 75% plus 100 mesh. Overflow to flotation is 2 to 3% plus 48-mesh; 50% minus 200-mesh, contains 47-50% solids.

Flotation rougher feed. 35 to 38% solids.

Lead concentrates: Average 5% moisture, assay about 76% lead.

Tailings: Average about 0.06% lead.

Flotation cells. Fagergren 66x60-in. rougher and cleaner cells were selected because they perform best on the medium-coarse range to which the ore is ground. However, 66x50-in. cells were selected for the recleaners because final cleaning action is accentuated in shorter cells. Pumper cells were installed between the cleaners and recleaners to break down the froth and reform a completely new feed for the final cleaning. The pumper cell eliminates the conflicting actions of aerating to float and de-aerating to pump within a single unit, thus facilitating upgrading of the final product.

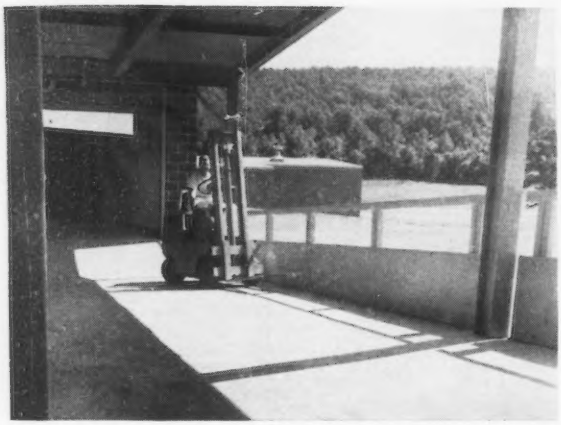
Reagents. During initial operations of the mill reagent, consumption was approximately as follows: Aerofloat Collector No. 31, 0.09 lb per ton; Cyanamid Frother No. 77, 0.03 lb per ton. Reagent consumption is low, chiefly due to the absence of pyrite. No lime or depressants are required.

Tailing disposal. Tailings from the zinc roughers are pumped through two 10x8-in. centrifugal pumps in series via a 12-in. tailings line to the head of a long valley, which is dammed up by the company truck roadway to form a tailings pond. A barge, anchored pivotally to one bank of the pond at the dam end, is arranged to vary the intake point, as the pond level fluctuates. It is equipped with two deep-well pumps, which will deliver return water to the mill reservoir through a 20-in. pipeline. Pumping will be done on off-peak power. Large slime ponds serve as artificial lakes and offer good fishing opportunities if properly stocked.

The Townsite

The city of Viburnum, now under construction and development West of the No. 28 mine and mill, is expected to have a population in excess of 2,000 when the three units of the Viburnum project get into full production of about 6,000 tons of ore per day. Viburnum will not be a "company town," even though St. Joseph Lead Co. will have made ex-

[1]Comments here apply to lead recovery in the mill during its initial operating phase. Operating conditions may be varied or improved, particularly if appreciable quantities of copper and zinc sulphide are encountered in future production.



CONCRETE RAMPS connect all operating levels of the mill to permit easy transport of materials from the warehouse, at right. Robert de Grant operates the fork-lift truck.

SPACEOUS systematically-stocked warehouse is situated centrally among surface-plant shops and buildings. Fred Jones, warehouse storekeeper, is proud of new facilities.

NEWLY COMPLETED HOMES in the Viburnum townsite promise gracious living for employees of the project. Other community features include wide streets, public school and playground, shopping center with central mall and an artificial lake.

penditures of about $600,000 for townsite planning, the shopping center, water and sewerage system, roads, school and some homes for company personnel. Approximately 500 lots have been set aside, which will vary from 80x150 ft to plots of about an acre. The school, plus about 20 acres of ground, will cost about $200,000. Employees will be able to purchase lots at a low cost per front foot, and build their own homes within specifications set down in the building restrictions designed to make Viburnum a clean, orderly and architecturally attractive living place. The city will have its own government, elect its own officers, operate its own civic agencies, and set tax schedules to finance its yearly operating budgets. As evidence of good faith, and to make employees aware of the stake that they have in the success of the Viburnum project, St. Joseph Lead Co. has intentionally located the No. 28 unit with mill and surface plant within the city limits of Viburnum.

Personnel at Viburnum

Elmer Jones, Division Manager, Southeast Missouri Mining and Milling Division, St. Joseph Lead Co.

L. W. Casteel, Assistant Division Manager

K. R. Baker, Superintendent Viburnum Division

Earl Holley, Mine Foreman, No. 27 Mine

Marvin Winkel, Mine Captain, No. 28 Mine

Lydle E. Pratte, Mill Superintendent, No. 28 Mine

E. J. Haug, Chief Research Metallurgist, Southeast Missouri Division

B. L. Beal, General Mechanical Superintendent

Tax levies on the property will help support the city's financial needs. Viburnum's town planners were Harland Bartholemew and Associates of St. Louis.

Improved county highways, running southeast from Cuba City on Highway 66 and westerly from the Bonne Terre area in Highway 67, pass through the Viburnum townsite.

Acknowledgments

E&MJ is indebted to Andrew Fletcher, chairman of the board of St. Joseph Lead Co., and Francis Cameron, president, for permission to publish this article. Elmer Jones, Manager of the Southeastern Mining and Milling Division, and L. W. Casteel, assistant division manager, and their staff associates and operators were most helpful in supplying facts, operating information and illustrations for the Viburnum story. Plant drawings and flowsheets are adapted from drawings prepared by General Engineering Co. of Canada Ltd. of Toronto, Ontario, designers of the Viburnum surface plant. Underground photos were taken by the company's staff photographer at the Bonne Terre office.

IRON ORE CO. OF CANADA'S Carol Lake project in Labrador, some 200 miles north of Seven Islands, is scheduled for completion in 1962. Capacity of the plant will be 7-million tons of high-grade iron ore concentrates per year. The project includes a 4,000-resident townsite, a 40-mile railroad, and an airport. Illustration, Courtesy Bechtel Corp., engineers.

Where Mining Is Heading in 1961

Economic Outlook for 1961. A barrage of year-end reports indicates that the first six-months of 1961 will bring no great upsurge in demand for metals. Some iron-ore and steel producers are predicting a slow six-month start for 1961. Opposed to these forecasts, we find the Department of Commerce predicting the highest year in history for private and public construction, totaling $57.3-billion for 1961, compared with 1960's $55.1-billion. Ford Motor Co. Tractor Division estimates that farm equipment sales will be 15% higher in 1961 than in 1960. Free World nickel consumption broke records in 1960 with a total of more than 500-million lb. International Nickel Co. predicts that the high-level consumption rate will continue through 1961. McGraw-Hill's survey of plant and equipment expenditures in the U.S. indicates that the total for 1961 will be $35.1-billion, down 3% from 1960's expected total. Metal producers everywhere, ferrous and nonferrous alike, are complaining about the low inventories of customers. This trend, which became accentuated during 1960, suggests that metal users intend to shift the capital tie-ups of inventory to producers. One economist points out that electronic computing makes inventory keeping more precise, hence the tendency to cut to the bone. Low inventories also mean that an upturn in demand for metal will materialize more speedily when general business conditions improve.

Mining's Momentum. E&MJ's survey of new and expanding mining projects on the following pages indicates that the current moderation in demand for metals is not interfering with the mining industry's traditional long-range planning program to provide the world's future mineral needs.

Technological Progress. Last year's tempo of new and exciting developments in mining and mineral processing technology continues, partly because of the liberal exchange of ideas at international symposia. Two are scheduled for the immediate future, one on agglomeration at Philadelphia April 12-14, and one at Rolla, Mo., on mining research, Feb. 21-25. (See E&MJ Mining Calendar p 4.) We may expect to hear more soon about hydroelectric rock breaking. Tests in the U.S. and Russia have demonstrated that high-voltage sparks aimed at rock surfaces under water can have an astounding shattering effect on the rock. Equally significant is Webb & Knapp's recent announcement that it is proceeding with plans to extract iron commercially by the Strategic-Udy process from Anaconda's copper slag pile in Montana. This decade may see a move away from the conventional Bayer process for the production of aluminum, and the introduction of reduction of metal not only from bauxite but from clays, anorthosite or syenite. A technical news item which appeared in E&MJ December 1960, p 149-50 is worth re-reading. It reports that Dow Chemical Co. has demonstrated a new blasting technique which utilizes "a unique explosive, called a 'metallized system,' representing the fruition of more than eight years' research." We don't know what metal is involved, but Dow is in the magnesium business.

International Mining. Political unrest in Cuba, Africa and elsewhere introduces a new hazard which may change the pattern of mining investments abroad. We may see more cooperative or group investments of the consortium type, such as is under study for the development of an aluminum industry on the West Coast of Africa and, for similar projects, in Australia. Disturbed by expropriation, or threats of expropriation, industrial leaders say they are willing to assume normal business risks abroad, but that losses caused by political blow-ups will have to be underwritten in some manner by the U.S. Government, or contemplated projects may not be started. The Toquepala project, E&MJ April 1960, in which four major U.S. copper producers participated, introduced a new element in industrial diplomacy. Because of the substantial economic risks involved, representatives of the Southern Peru Copper Corp. and technical, legal and government officials representing Peru, negotiated a working agreement, equitable to the people and Peru and to participating companies, and published this working agreement in English and Spanish in the PERUVIAN TIMES. Such a document of good intent might not be feasible when companies are required to deal with dictators, but it might discourage a repeat of the Cuban incident. One upshot of foreign unrest is that potential mineral resources in the U.S. look mighty attractive to exploration engineers at this time.

KENNECOTT'S MILL EXPANSION at Ray Mines Division increased capacity to 22,500 tpd. New crushing plant, conveyor and mill buildings are shown. Stearns-Roger installation.

ANACONDA'S $6-MILLION replacement and modernization program in Montana is intended to keep production from the Berkeley pit and underground mines competitive.

Projects Announced or Starting Construction in 1960

MANGANESE

New Johnsonville, Tenn. Foote Mineral Co. has authorized construction of a 10,000-tpy electrolytic manganese plant due in late 1961 or early 1962. Cost will be over $6-million

Aberdeen, Miss. American Potash & Chemical Corp. began construction of $5-million electrolytic manufacturing plant with initial capacity of 5,000 tpy, to be completed in late 1961.

IRON ORE

Mauritania, Africa. World Bank loaned Societe Anonyme de Mines de Fer $66-million to begin construction of a 6-million tpy open pit. Pit will produce in two years at cost of $190-million.

Anaconda, Mont. Koppers Co. is designing a $30- to $40-million steel mill for Webb & Knapp Strategic Corp. for extracting about 350,000 tpy of steel from the copper slag pile. Construction will begin May 1961.

Iron Springs, Utah. A $1.9-million beneficiation plant will be built by Utah Construction & Mining Corp.

Atlantic City, Wyo. A $50-million mining and beneficiation project was begun June 1. The pit, owned by Columbia-Geneva Div. of U.S. Steel Co., will be in operation by late 1962.

New York. New 3,800-tpd sinter plant is now under way by New York Ore Div. of Jones & Laughlin Steel Corp.

Mindanao, Phillippines. Itoh Trading Co. of Japan jointly with Surigao Consolidated will develop the Pionia mine, north of Pagadian, which has an estimated 6-million tons of ore.

Wyoming. Western Steel Co., Inc. will build a $145,000 prototype iron-powder producing plant using the Taylor process.

Kingston, Ont. New Mylamaque Explorations Ltd. is negotiating with Koppers Co. and Strategic Materials Corp. to construct a $14-million concentrator and direct-reduction iron plant.

Cranberry, N.C. Cranberry Iron & Steel Co., newly formed, will build $4-million electric furnace smelter and reactivate old mine at 400 tpd.

Lake St. John area, Quebec. Sulphur Converting Corp. began construction of a $40-million sulphur and steel complex June 1. Production is due in four years.

Koolan Island, Australia. A 2-million tpy iron mine is in the works at a cost of $14-million.

Eveleth, Minn. North Range Mining Co. is developing a new open pit mine, the Nahma, which is an extension of the old Leonidas mine.

Ashcroft, Colorado. Pitkin Iron Corp. was organized to mine a deposit.

COPPER

Queensland, Australia. Japan's Nippon Mining Co. will spend over $2-million to build a treatment plant in Queensland, and has made plans to spend about $1.3-million a year on Australian copper purchases.

Quebec. Decision to put Solbec Copper Mines property into production at 1,000 tpd has been made. New shaft and mill are being worked on.

Highland Valley, B.C. Japan's Sumimoto mining group will put up from $7.5- to 9-million to finance production at Bethlehem Copper Corp. Ltd.'s property.

Chapi, Peru. Japan Mining Co. bought a mine and plan processing 10,000 tpm of ore.

Northern Rhodesia. Chibuluma Mines Ltd. plans development of a 2-million ton, 4.81% orebody by the end of 1961.

Conconully, Wash. Sunny Peak Mining Co. will develop a vein of copper-silver ore.

Ventanas, Chile. West Germany's Kloeckner-Humboldt-Deutz, an association of machine manufacturers, will finance a copper refinery. The smelter will process blister copper from Central Chilean ores, and will cost $11-million.

Yerington, Nev. Anaconda Co. will construct a 5,000-tpd concentrator for sulphide ores.

BAUXITE-ALUMINA-ALUMINUM

France. Two French firms are jointly constructing a pilot plant which will produce aluminum by the new method developed by France's Pechiney and Ugine which eliminates the alumina stage.

Ghana. Volta Aluminium Co. Ltd. plans to construct a $178-million 180,000 long tpy smelter, which will utilize power from the proposed Volta River hydro-electric dam at Akosombo.

Arvida, Que. Aluminium Ltd. is now building a $4-million aluminum plant which uses a new process developed by France's Pechiney and Ugine that eliminates the alumina stage. Initial output of the pilot plant in 1962 will be between 3,000 and 5,000 tpy.

Vera Cruz, Mexico. Alcoa is going ahead with a $20-million aluminum plant.

Cape York, Australia. Kaiser Aluminum Co. and Consolidated Zinc Corp. plan a $450-million mine and refinery to produce 360,000 long tpy alumina.

Bluff, New Zealand. Kaiser Aluminum Co. and Consolidated Zinc Corporations Ltd. will build a 280,000-kw power plant and a 120,000 long tpy reduction plant.

Maharashtra, India. A 20,000-ton aluminum plant to be built by Tendulkan Industries in collaboration with Aluminum Company of America will cost $30-million.

Jamaica. Aluminum Co. of America expects to ship bauxite from their 30,000 acre concession on June 1, 1963.

San Felix, Venezuela. The government has given its go-ahead for the $13.5-million, 25,000-tpy reduction plant which Reynolds Metals Co. wants to build.

The Dalles, Oregon. Harvey Aluminum Co. signed a contract with the Bonneville Power Administration for power for a proposed 75,000 tpy reduction plant to be built in the Pacific Northwest.

Baton Rouge, La. Kaiser Aluminum & Chemical Corp. will build a $700,000 plant to produce active alumina with a spheroidal shape.

LEAD-ZINC-SILVER

New Market, Tenn. Tri-State Zinc, Inc. will spend $3- to $4-million developing a new zinc mine and erecting a 3,600 tpd mill.

Tennessee. New Jersey Zinc Co. plans to develop another zinc mine in the Copper Ridge District.

Lithgow, Australia. Lithgow Smelters Pty. Ltd. will build a custom treatment plant for lead, zinc, copper and silver, which will treat ore from various deposits in New South Wales.

Boquira, Brazil. Companhia de Acumuladores Presto-Lite has formed a subsidiary, Companhia Brasileira de Chumbo to mine and refine lead at Boquira, in the state of Bahia. The company is expected to account for ¾ of Brazil's 20,000 tpy lead production in 1961.

Stevens County, Wash. A 1,000-tpd concentrator is being moved to Clayloon Uranium Co.'s lead mine where 60,000 tons of ore is now ready for milling.

North Carolina. Tennessee Copper Co. is readying the Silver Bell mine for production.

Bathurst, New Brunswick. Brunswick Mining & Smelting Corp. will build a 2,000 tpd concentrator to develop a large deposit.

KAISER STEEL CORP'S $22.7-million Eagle Mountain project includes a 51-mi railroad, townsite, crushing, blending, beneficiation facilities. Photo courtesy Kaiser Engineers.

QUEBEC CARTIER'S $50-million iron ore concentrator has 8-million tpy capacity. The process uses spirals, concentrators and autogenous grinding. A Kaiser Engineers project.

URANIUM

Shirley Basin, Wyo. Petromics, a partnership of Kerr-McGee, Tidewater Oil, Skelly Oil and Getty Oil, will probably build a $3-million, 300-tpd mill to supply the AEC with 3 million pounds of concentrates. Stripping of the pit has begun.

Mt. Spokane district, Washington. Daybreak Uranium Inc. is opening a new orebody.

Rawlins, Wyo. Hack Engineering Co. will build a 150-tpd (may be increased to 500 tpd) plant for the Lucky June Mining Co. A new process for producing yellow cake will be used in which reagent cost will be 20¢ per ton.

Falls City, Tex. Susquehanna-Western Inc. built Texas' first uranium plant, with a capacity of 200 tpd, at a cost of $2-million.

NICKEL

Bindura, Southern Rhodesia. Japanese investers will build a $2.8-million nickel smelting and refining plant.

Ontario. Falconbridge Nickel Mines is sinking the first development shaft at its Strathcona nickel property. Expected production, in 5 to 6 years, will be 4,000-6,000 tpd.

Ontario. International Nickel Co. will begin production from its new Clarabelle open pit nickel mine by late 1961, to replace exhausted reserves.

Dominican Republic. A Canadian-Dominican enterprise, Mineral y Beneficiadora Falconbridge is exploring the back country nickel reserves, and has started construction of a nickel pilot plant.

LaMotte Township, Quebec. Falconbridge Nickel Mines, Canadian Malartic Gold Mines, and Marchant Mining Co. have formed a new operating company to work a high grade nickel property at a rate of 400 tpd.

COLUMBIUM

Brazil. Molybdenum Corp. and Wah Chang Corp. will build a columbium mill. Completion is scheduled for mid-1961.

Araxa, Minas Gerais, Brazil. The Brazilian firm, Distribuidora-Exportadora de Minerios S.A. (Dema), is investing $1.5-million in a columbium ore-processing plant which will start production early 1961. The deposits assay 3.5% columbium.

MISCELLANEOUS METALS

Elliot Lake area, Ontario. Rio Tinto Dow Ltd. will build a new thorium plant, costing $400,000, to be completed about March, 1961, at the Nordic plant site of Rio Algom Mines.

Salt Lake City, Utah. Minerals Engineering Co. of Grand Junction, Colo., and Susquehanna-Western Inc., Denver, have formed a joint-venture operation to produce vanadium pentoxide in their newly acquired plant.

Azna, Iran. An Anglo-German syndicate of West Germany's Demag and Krupp industrial complexes, and the British Meeco concern, has signed an agreement with the Iranian government to build a 300,000 tpy metallurgical plant, Iran's first.

Baie St. Paul, Quebec. Continental Titanium Corp. will build a $2-million, 10-tpd, titanium dioxide production plant in 1961.

Sutton, Alaska. Kaiser Permanente Co. plans to construct a $5-million cement manufacturing plant, with an initial capacity of 500,000 barrels annually.

Lincoln County, Idaho. Electro-Nuclear Metals Co. will construct a $2-million zirconium-hafnium plant.

Northwest Territories, Canada. Open-pit production of a tungsten mine currently being developed by Canada Tungsten Mining Corp. may begin by late 1961.

South Dakota. Northwest Defense Minerals Inc. will build a 100-tpd flotation mill to process beryl from pegmatites.

Northern Mexico. Fluorspar mining in northern Mexico is expanding rapidly. Among the companies now working in the area are: du Pont, Dow, Noranda Mines of Canada, Stauffer, Allied, Asarco, Aluminum Co. of America, Pennsalt, Continental Ore, Reynolds Metals Co., and Union Carbide.

NONMETALLIC MINERALS

Green River, Wyo. Stauffer Chemical Co. will complete a 150,000 to 200,000 tpd soda ash plant and mine by 1962. Cost will be $20-million.

Vernal, Utah. A 6,000 tpd phosphate mill is being built by San Francisco Chemical Co. to develop a low-grade deposit. Project will cost $6,375,000 and be completed by the third quarter of 1961.

Van Horn, Tex. Continental Minerals will build a 80 to 100-tpd (one shift) mill to process barite.

Safi, Morocco. Sutrina Co. will build a 200,000 tpy phosphate plant at a cost of $13-million.

Spindletop, Tex. Texas Gulf Sulphur will build a sulphur filtration plant for $1-million.

Baltimore, Maryland. United States Gypsum Co. will build a plant to process gypsum from Nova Scotia.

Birch Island, British Columbia. Rexspar Minerals & Chemicals Ltd. plans to open-pit mine its fluorspar deposits and build a $3.5-million plant.

Republic of Guinea. Soviet equipment and technicians will help prospect and develop gold and diamond deposits under agreement signed by the two countries.

Flat Bay, Newfoundland. Flintkote has secured an agreement with the government to mine gypsum starting in spring, 1961. Output will be 500,000 tpy.

Vicksburg, Miss. American Metal Climax Inc. will construct a $7-million nitrate of potash and chlorine plant. Scheduled completion date is October 1961.

Cane Creek, Utah. Texas Gulf Sulphur Co. plans production from a $20-million potash mine and refinery by 1963. Production may be 12,000 tpd.

Wilmington, Delaware. Bestwall Gypsum Co. has begun construction on a $7.5-million plant.

Baie Verte, Newfoundland. Four companies, Canadian Johns-Manville Co. Ltd., Patino of Canada Ltd., Amet Corp., of Switzerland, and Financiere Belge D'Asbest-Ciment, of Belgium, will spend $18-million to develop an extensive asbestos deposit.

Cleveland, Ohio. International Salt Co. will open a new salt mine.

These Projects Are Still Under Construction

MANGANESE

Gabon, Africa. World Bank loan of $35-million has been made to Comilog. First ore is due out in 1962 at 500,000 tpy. Transportation is a major cost item—cableway and 180-mile railroad. Total cost is expected to be $89-million. Project involves U.S. Steel and French interests.

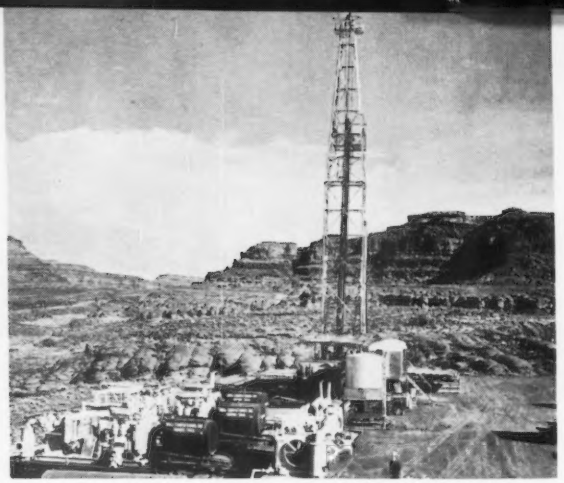
Newport News, Va. Union Carbide is building a 30,000-ton per month manganese ore dressing plant to treat British Guiana ore.

IRON ORE

Guinea. Societe des Mines de Fer de Mauritanie is spending $168-million to develop a 6-million tpy mine.

Wabush Lake, Labrador. Wabush Iron Co. Ltd. — Inland Steel, Pickands Mather and others—is developing mine and concen-

INTERNATIONAL NICKEL CO.'S $125-million Thompson project in Manitoba is scheduled to begin operation in early 1961. Annual capacity of the operation is 75-million lb nickel.



TEXAS GULF SULPHUR CO. announces discovery of one of the nation's richest potash deposits near Moab Utah. If developed, mine and mill for project will cost $20 to $30-million.

trator for 4- to 5-million tpy output (pellets) by 1965. Due onstream in 1961. Total cost is about $200-million.

Pea Ridge, Mo. First ore has been developed at mine of Bethlehem Steel and St Joseph Lead Co. which is due onstream in 1963 at cost of $40-million.

Que Que, Federation of Rhodesia & Nyasaland. Rhodesian Iron & Steel Co. is developing a 30-million ton deposit and building a $22.4-million steelworks. Aim is for 150,000 ingot tons of steel per year when at capacity.

Adrianitas, Chile. Mitsubishi Shoji Kaisha Co. will soon begin moving 10-million tons of high-grade iron.

Finland. Outkumpu Oy will exploit an iron ore find with 50-million West German mark loan at 600,000-tpy ore to yield 5,000-tpy copper, 18,000-tpy zinc, and 160,000-tpy iron ore. Reserves are sufficient for 30 years.

Kimberley, British Columbia. Consolidated Mining & Smelting are constructing a steel producing center to use old mill tailings (15-million tons with newly mined 350,000 tons added each year. Cost will be $20-million, onstream in 1961 at 100,000-tpy output (36,500-tpy electric steel).

Varennes, Que. Quebec South Shore Steel Corp. is building a Udy Process steel center, due in 1961 at a cost of $22-million—two electric furnaces for 150,000-tpy of pig iron.

Ulu Rompin, Malaya. Eastern Mining & Metal Co. plans to open a 2.5-million-tpy mine to replace worked-out Dungun. Cost—$50-million. Reserves are 17-million tons, 62% Fe.

Gabon. Societe des Mines de Fer de Mekambo will spend $350-million (1959) to open high-grade deposit which includes 460-mile railroad. Bethlehem Steel owns 50%. Due to produce in late 1964. Rate in 1967 is to be 10-million tpy.

Ungava Bay, Que. Cyrus Eaton and Fried. Krupp will share cost of constructing a mine, mill and harbor (and ore boats) for Ungava Iron Ores Ltd. Eventually capacity is to be 5-million tpy. Cost estimate is in excess of $200-million.

Sibuguey, Philippines. Samar Mining Co. is pushing construction of a mine on high-grade 7-million ton orebody. Spent $500,000 on road to mine.

Minnesota. Hallet Construction Co. is dredging overburden from the Jessie H. mine.

Chisholm, Minn. The new concentration plant at the Sherman mine, Oliver Iron Mining Div., is expected to be completed for the 1961 season.

Carol Lake, Labrador. Iron Ore Co. of Canada will build a 7-million tpy pellet mine and mill at cost of $150-million. One orebody of several in area has 400-million tons, 35% Fe. Due in 1962.

Erie, Mich. Alnore Mineral Co. expects its new custom-grinding plant to be in operation soon.

Kimberley, B.C. Cominco is building a $20-million plant for production from tailings of the Sullivan Concentrator's 11,000 tpd lead-zinc output.

Port Cartier, Que. Quebec Cartier is building a harbor, railway, two terminals, open pit mine and concentrator to produce 8-million tons of concentrate annually at cost of $300-million. Due in 1961.

COPPER

Mauritania. Societe des Mines de Cuivre le Mauretanie (Micuma) has completed pilot plant work (1958) on two deposits—30 million tons, 1.5% Cu and 30% Fe with oxide cap running 2.5% Cu; and 15-million tons, 52% Fe. A 124-mile railroad must be built.

Chile. National Smelters Corp.'s smelter is expected to be ready by the end of 1962.

Mackay, Idaho. Mackay Exploratory Co.'s mine is now operating with sixteen men. A 100-tpd mill will soon be constructed.

British Columbia. Canam Copper Co. will soon hit its orebody at the end of a 6,000 ft adit. The property has 3¼-million tons of commercial ore.

Tocopilla, Chile. Foram Chilena is building a 150-tpd leaching plant to treat oxidized ore from the Mantos de la Luna mine south of Tocopilla. The ore will be shipped to the mill by a two-mile aerial ropeway.

Little Bay, Newfoundland. Atlantic Coast Copper Corp.'s 800- to 1000-tpd mine-mill is due for production about March 1, 1961.

British Columbia, Canada. Granby Mining Co. Ltd. is re-opening the old Phoenix mine after 40-year shutdown. Mine and mill will handle 5,000 tons a week.

Tocopilla, Chile. Cia Minera de Tocopilla is erecting a leaching plant at the 300-tpd flotation mill; will use 7-tpd acid.

Rio Blanco, Chile. Cerro de Pasco Corp. will mine and mill at 11,000 tpd a large orebody—112-million tons, 1.6% Cu. Mining will be by block-caving and the cost will be $70-million ($90-million with a smelter).

Alaska, Southern Rhodesia. Messina Rhodesia Smelting & Refining Co. is erecting a $2.1-million copper refinery.

Southern Rhodesia. Messina (Transvaal) Development Co. is completing reconstruction of the Alaska mine at a cost of $1.4-million. Output will be 2,600 ltpy of concentrate.

Arizona. Stripping has begun on American Smelting & Refining Co.'s Mission Project. The 15,000 tpd mine will include a $43.5 million plant to produce 45,000 tpy copper by early 1962.

Arizona. Bagdad Copper Corp. is instituting a $2-million leaching-in-place program, including construction of a plant for sulphuric acid production from elemental sulphur. Output from stockpiled ore is estimated at 20 tpd and is due in 1961.

Christmas, Ariz. Work is progressing rapidly on Inspiration's mine and mill. The 20-million ton, 1.83% Cu, $15-million project is due in 1961.

Merritt, British Columbia. Craigmont Mines Ltd. expects production from its 4,000-tpd mill by the end of 1961.

BAUXITE-ALUMINA-ALUMINUM

Guinea. Fria—Olin Mathiesson, Pechiney, Ugine, British Aluminium and Aluminum Industries, AG, plan to have $135-million operation onstream in 1962. Reserves are 1.5-billion tons of bauxite. Cost is for $80,000-tpy alumina and 150,000-tpy aluminum.

Guiana. Kaiser Aluminum and Bureau Miniere Guyanais have formed a consortium to produce bauxite from 70-million ton Kaw Mountain deposit.

India. Kaiser Aluminum & G. D. Birla are building a $30-million alumina-aluminum project. Due onstream in 1962.

Vera Cruz, Mexico. Alco plans a $20-million, 20,000-metric tpy refinery.

Uttar Pradesh State, India. A $30-million reduction works and power plant will give Hindustan Aluminum Corp. Ltd. 20,000 tpy aluminum in 1962.

Surinam. Alcoa is spending $45-million on a 150,000-kw hydroelectric project and planning a 60,000-tpy reduction works to cost $150-million. Due in 1965.

Borneo. Aluminium Ltd. is developing a 175,000-tpy bauxite mine.

GOLD

Sapawe, Ont. Lindsay Explorations has resumed sinking of three-

TOPAZ MOUNTAIN, UTAH, was the scene of intense exploration for beryllium. View from air shows discovery cuts made to validate the numerous mining claims staked.

FIELD GEOLOGISTS of Beryllium Resources, Inc. plot geologic outcrops on claims near Topaz Mt. James Jones and Joseph Leisak are at work with plane table and stadia rod.

compartment shaft to 400 ft. depth. Construction of a 100-ton cyanide mill will be finished this summer.

Tofino, B.C. Allied Mining Services Ltd. is installing a five-ton mill on the Tofino Gold Mines property. Underground work is concurrent with mill installation.

Val d'Or, Que. Sigma Mines is well into its $1-million shaft sinking program at its Val d'Or property. The work will be completed first quarter 1961.

Transvaal and Orange Free State, Africa. A total of $182-million is being spent for gold development. The Anglo American mine in the Far West Witwatersrand will be sunk to 8,500 ft. in two stages.

Union of South Africa. Rand Mines and Western Areas will go ahead with a mine—two shafts are going down.

Union of South Africa. Western Deep Levels Ltd. will start milling ore by late 1962.

LEAD-ZINC-SILVER

Bachelor Lake, Que. Coniagas Mines has announced plans to bring its property into 400 tpd production by March 1961. Ore reserves at 650 ft horizon assay 15.7% Zn, 1.04% Pb and 8.77 oz Ag per ton.

Lake Pend Oreille, Idaho. Federal Uranium Corp. is deepening its shaft at the Conjecture Mine by 1000 ft.

Australia. Sulphide Corp. Pty. Ltd. is building one sinter plant and one zinc blast furnace by 1961 at 38,000 tpy zinc and 40,000 tpy lead.

Spain. Sociedad Austuriana del Zinc is erecting a 20,000-tpy electrolytic zinc refinery.

Udiapur, India. Metal Corp. of India and Rio Tinto are cooperating on a $12.6-million zinc smelter.

MISCELLANEOUS METALS

Thompson, Manitoba. International Nickel Co.'s project is to be onstream by 1961 with planned capacity of 75-million lb of nickel a year from Moak-Mystery Lakes mines, mills and the smelter. Total cost will be over $175-million.

Ocean County, N.J. Glidden Co. has purchased inland beach sand deposit from American Metal Climax Inc. and will mine and mill. A pilot plant is operating.

Minas Gerais, Brazil. Brazilian-Japanese group, National Steel Co. and Vale do Rio Doce Iron Co. are completing a 500,000-tpy mine and concentrator with estimated cost at $57-million (1958).

Antofagasta, Chile. Nippon Mining Co. and Daiichi Bussan Kaisha are developing Portequela open pit to produce 100 tons per month contained metal to be refined in Japan.

Lacq, France. Ugine is building a second electrolytic aluminum plant of 23,000-tpy capacity and Pechiney is building a 50,000-tpy facility (1958).

Bangka Island, Malaya. Bangka Mining Co. plans a $3.5-million tin smelter to yield 25,000 tpy.

NONMETALLIC MINERALS

Wyoming. Ground was broken in mid-March for a new $3-million gypsum plant by Big Horn Gypsum Co. Plant will use 25 carloads daily.

Napa, California. Asbestos Bonding Corp. finished the first unit of their 1,000-tpd asbestos plant in July. Plant will cost $1-million.

New Mexico. Duval Sulphur & Potash Co. is spending $2-million to sink new shafts and build surface installations at its new production site.

Elliston, Idaho. The Jack Pine mine is being developed to furnish feed for Bunker Hill's new phosphoric acid plant.

Esterhazy, Sask. International Minerals & Chemical plans to have a $20-million mine and potash refinery onstream by mid-1962 to yield 720,000 tpy potash.

Esterhazy, Sask. Continental Potash Co. is sinking a 3,300-ft shaft, plans 112,000 tpy of potash.

Stockton, Calif. Jefferson Lake Sulphur Co. purchased American Asbestos Co.'s 15-million ton chrysotile deposit and is building a 2,000-tpd mill.

Expansion Programs Going On Here

MANGANESE

United Arab Republic. Sinai Manganese Co. has launched a $1.5-million reequipment program in order to produce 200,000 tons of ore in 1960. Original equipment was destroyed in war.

Knoxville, Tenn. Foote Mineral Co. increased the capacity of its Loraine plant by 30%.

IRON ORE

Babbit and Silver Bay, Minn. Reserve Mining Co. has announced plans to spend more than $120-million to double the size of its taconite operations in Northern Minn., including increasing the Silver Bay taconite plant to 9-million tpy pellets.

Michigan. Cleveland-Cliffs Iron Co. plans to increase capacity of the Republic Mine from 700,000 tpy concentrate to 1.6-million tpy.

Krivoi Rog, U.S.S.R. Tass reports that mechanization of an open-cast iron ore mine in the Krivoi Rog basin will speed output to 140 tons per man in a six-hour shift and exceed U.S. productivity at similar mines.

Humboldt, Mich. Humboldt Mining Co. has doubled capacity of its plant to 2,000 tpd.

Natal. A new $6.3-million furnace upped African Metals Corp.'s pig iron capacity by 600 tpd.

Peru. Macoona Mining Co. is going ahead with its $25-million expansion program.

Michigan. M.A. Hanna Co. upped production to 4-million tons compared with 1.8-million in 1959.

Minnesota. Coons Pacific Co.'s concentrating plant is being expanded 50% to 1.5-million tpy crude ore.

Copper Cliff, Ont. International Nickel Co. of Canada, Ltd. is beginning a $50-million expansion of its ore recovery plant.

COPPER

Chile. National Mining Enterprise will spend $2.1-million on new mills and extensions to its operations.

Weed Heights, Nev. Anaconda Co. has started work on a $6-million addition to its copper refining plant.

Chile. El Salvador is now producing at 24,000 tpd ore, or double initial tonnage.

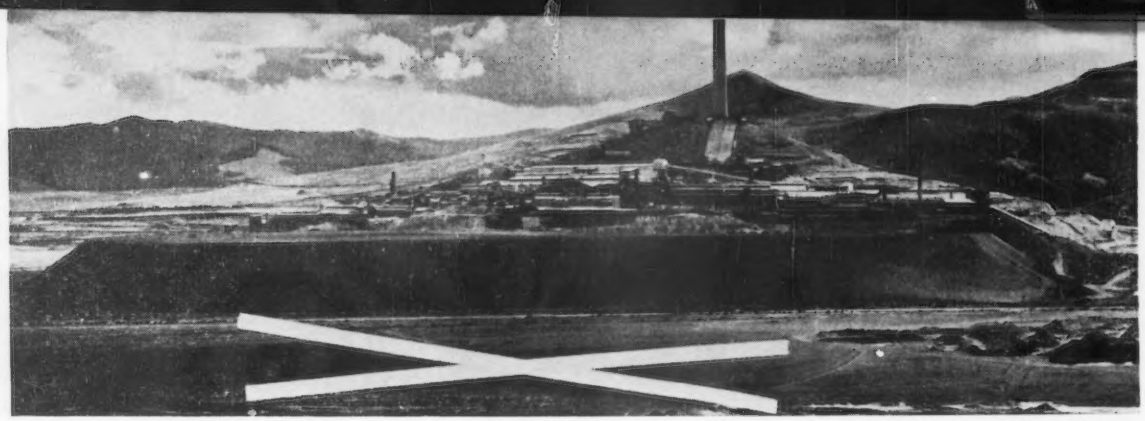
Northern Rhodesia. Nchanga Consolidated Copper Mines Ltd. has announced plans for a $5.6 to 8.4-million leaching plant which should increase its copper production by 15,000 tpy.

Quebec. Opemiska Copper Mines is now milling copper-gold ores at 2,000 tpd, up 50% from last year.

Northern Rhodesia. New shafts are being sunk at the Chibuluma West mine to increase production by 4,000 long tpy copper.

Anaconda, Mont. Anaconda Co. has embarked on a $6-million modernization program at its Anaconda smelter.

Butte, Montana. Major modernization project is going ahead at Anaconda's mines.



ANACONDA'S COPPER SMELTER and other plants in Montana are undergoing a $6-million replacement and modernization program. Plans are underway by Webb & Knapp Strategic Corp. to build a $34- to $40-million reduction plant at site X to recover iron from the adjacent 40-million-ton copper slag pile by the Strategic-Udy direct-reduction process.

Chile. Production should gain by 100,000 tpy from Kennecott's planned $200-million expansion program.
Chibougamau, Que. Campbell Chibougamau Mines is expanding the mill rate at its Chibougamau copper-gold mine from 2700 to 3000 tpd. The work should be completed in the fall of 1961.
Australia. At Mt. Isa, copper-smelting capacity is being raised to 60,000 tpy.

BAUXITE-ALUMINA-ALUMINUM

Bell Bay, Tasmania. Kaiser Aluminum Co. and Consolidated Zinc Corp. will expand reduction works to 28,000 long tpy from 12,000 tpy.
Longview, Wash. Reynolds Metals Co. will spend $600,000 to expand its reduction plant, scheduled for completion in 1961.
Cape York Peninsula, Australia. Commonwealth Aluminium Corp. is engaged in a $450 million development project. Kaiser-Consolidated also plans to continue research and to build a 360,000 long tpy refinery.
Yugoslavia. The Kidricevo plant will boost production from 14,700 metric tons in 1959 to 30,000 tpy.
Hirakud, India. Indian Aluminium Co. Ltd. plans to increase ingot capacity from 11,200 tons to 22,400 tons. Cost will total $17-million.
The Dalles, Oregon. Harvey Aluminum Co. will up production capacity 25% by the first quarter of 1961.

LEAD-ZINC-SILVER

Broken Hill, N. Rhodesia. A new $11.2-million smelting furnace to treat low grade ore will double Broken Hill Development Co.'s annual capacity by 1962. New figures will be 28,000 long tpy lead and 55,000 long tpy zinc.
Utah. United Park City Mines Co. has developed hundreds of thousands of tons of new ore by sinking a 400-ft winze.
Tenn. New Jersey Zinc upped their Treadway mine production to 3,000 tpd.
Queensland, Australia. Mt. Isa Mines will spend $7-million to up capacity from 8,000 to 14,000 tpd.
Peru. Cerro de Pasco will spend $6.8-million to increase its La Oroya zinc plant from 32,000 to 52,000 tpy, and its Cerro de Pasco lead-zinc concentrator from 42,000 to 65,000 tpy, copper concentrator from 35,000 to 50,000 tpy. Both projects will be finished by mid-1962.

GOLD

Val d'Or, Quebec. Sullivan Consolidated Mines has raised mill rate from 500 to 725 tpd.
Bourlamaque, Quebec. Barnat Mines' gold production will be increased to 1850 tpd by mid-1961. The ore grades 0.153 oz per ton.
West Witwaterstand, South Africa. A $25-million milling development by New Consolidated Gold Fields will boost capacity of West Driefontein mine from 120,000 to 205,000 tpm by 1964.

MISCELLANEOUS METALS

Gas Hills area, Wyo. Federal Uranium-Gas Hills Partners will build a $180,000 modification to its uranium processing mill to increase plant capacity from 529 to 800 tpd. It will process ore from a newly-found ore body between 100 and 150 ft deep which will be mined by open pit.
Cleveland, Ohio. Brush Beryllium Co.'s heavy expansion program will double the company's 1959 capacity by the end of 1961.
Gabbs, Nev. In October, Basic Inc. completed a multi-million dollar expansion program at its mine and mill site. The flotation mill is designed to handle 500 tpd and produce magnesite concentrates for kiln feed.

NONMETALLIC MINERALS

British Columbia. Cassiar Asbesto Corp. upped its mill capacity to 1,500 tpd from 1,000 tpd.
Jordan. Jordan Phosphate Mining Co. is expanding phosphate production from 320,000 tpy to 600,000 tpy by 1963 with help of a $1.5-million grant from U.S. Development Fund.
Chile. Anglo-Lautaro Nitrate Co. announced a $14-million expansion of their nitrate plants.
Carlsbad, N.M. American Metal Climax Inc. will spend $3-million for expansion of the Southwest Potash Corp. facilities in Carlsbad.
Wyoming. Food Machinery & Chemical Corp. is expanding soda ash production at its Green River plant from 520,000 tpy to 720,000 tpy by 1962.
Bonanza, Utah. American Gilsonite Co.'s new mining method and pipeline will up gilsonite capacity from 650 to 1,100 tpd.
Salta, Argentina. Borax Argentina, S.A. is expanding its Salta borax plant with U.S. equipment; borax reserves are said larger than California's.
Chile. Compania Salitera de Tarapaca & Antofagasta increased the capacity of its Victoria nitrate plant from 12,000 to 18,000 tpm.

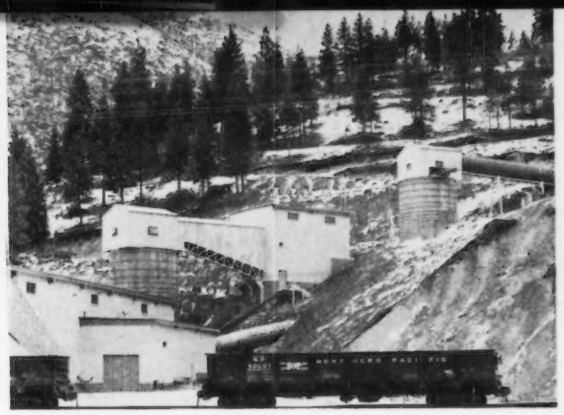
Projects Onstream in 1960

MANGANESE

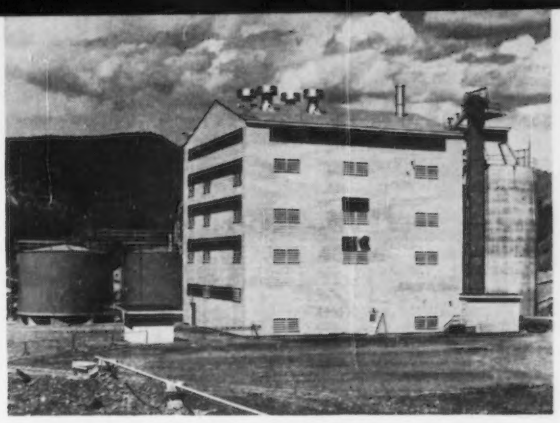
Maharashtra, India. Khandelwal Ferro-Alloys Ltd. has commenced production at its new, 44,000-tpy ferromanganese plant in the Dandeli district. Output will be bought by the U.S. Continental Ore Corp. until 1964.
British Guiana. African Manganese Co. put a property in production in 1960. Railroad alone cost $7-million (1957).

IRON ORE

Grand Rapids, Mich. Jones & Laughlin's 700,000-tpy Lind-Greenway mine is now producing high-quality beneficiated ore.
Los Angeles, Calif. Bethlehem Pacific Coast Steel Corp. has built a 110-tpd H-Iron plant.
Minnesota. First carload of ore from M.A. Hanna Co.'s Pierce Mine was loaded April 7. Production for 1960 exceeded 1-million tons. A 1250-tpd crusher is in the pit.
Chile. The Adrianitas mine went on stream at end of year. Mine belongs to Mitsubishi Co. Cost to open the pit was under $300,000 but $1.5-million was spent on new rail spur.
Steep Rock Lake, Ont. Caland Ore Co. began operations with 900,000 tons for 1960. Production will be 3-million tpy by 1969.
El Laco, Chile. Compania Minera Santa Fe began shipping ore from the El Carmen mine. Cost was about $250-million, including railroad, seaport and town.
Labrador. Wabush Iron Co. Ltd.'s pilot plant began operations in February and processed 50,000 tons of ore in 1960.
Cranberry, North Carolina. Cranberry Magnetite Corp. is producing about 100 tpd in operations spanning the North Carolina-Tennessee mountains. A $4-million electric melting furnace is planned.
Algarrobo, Chile. Compania Acero del Pacifico put its $20-million high-grade iron mine into production. Over 100-million tons are proved.
Ishpeming, Mich. Cleveland-Cliffs Iron Co. and Ford Motor Co., joint owners of the Humboldt Mine, have opened a 650,000 tpy iron-ore pellet plant.
Monterrey, Mexico. Hojalata y Lamina, parent company of Fierro Esponja, completed construction of a 500-tpd HyL Process sponge iron plant.
Lac Jeannine, Que. Quebec Cartier (U.S. Steel) has its mine and



LUCKY FRIDAY'S NEW MILL in the Coeur d'Alene district went on stream in 1960. The 500-tpd, $800,000 mill processes rich silver-lead-zinc ore from the mine near Mullan, Idaho.



BUNKER HILL CO.'S newly completed $2-million phosphoric acid plant constructed near Kellogg, Idaho, has a rated capacity of 130 tons of phosphoric acid per day.

pelletizer in initial production. Eventual capacity of 8-million tpy, 66% Fe pellets is planned. Cost (including 163-mile railroad) is $300-million.

COPPER

Toquepala, Peru. Southern Peru Copper Corp. began production at their $237-million enterprise. Production will be about 140,000 tpy of blister copper.

Arizona. Banner Mining Co. put their Palo Verde shaft to work late in the year. Production is to be 1,000 tpd high grade ore.

Mantos Blancos, Chile. Mantos Blancos went onstream. Cost is about $18-million for mine, acid-leach plant and fire refinery. Mauricio Hochschild interests have 10.5-million ton reserve. Will leach about 2,000 tpd for 12,500-tpy cement.

Meme Valley, Haiti. Sedren S.A. completed a 1,500-tpd flotation mill for the mine—high-grade bornite and chalcopyrite.

Newfoundland. Atlantic Coast Copper built an 800-tpd mill.

Ontario. Violamac Mines brought its Kam-Kotia open-pit property into production in Aug. A 750-tpd mill was purchased and a 1,000 tpd crusher installed.

Chile. Compania Minera Cerro Negro, which has mines and a 300-tpd flotation mill near Cabildo, has been successful in developing its new deposit of El Liablo after the Pirquitas mine was worked out.

Flin Flon, Manitoba. Hudson Bay Mining & Smelting is completing the development of Stall and Chisel Lakes mines.

BAUXITE-ALUMINA-ALUMINUM

Guinea. Fria Compagnie Internationale pour la Production de l'Alumine started production from its alumina plant at 550-tpd. At full capacity it will produce 480,000 tpy.

GOLD

Red Lake, Ontario. H. G. Young Mines Co. is processing about 250 tpd of ore at its Red Lake gold mine, and expects soon to up its capacity to 500 tpd.

Pateros, Washington. Paymaster Mines Inc. has completed construction of a 50-tpd mill.

Bannack, Mont. Spokane National Mines Inc. has started milling ore at a rate of 75 tpd at its Bannack property.

Bolivia. Over 5000 oz per month are produced by South American Placers Inc.'s dredge on the Kaka River.

Nelway, B.C. Skookum Uranium Inc. has started production at a gold placer property.

Lewiston, Idaho. Idaho Mining & Milling Co. has moved a dredge into the Florence basin area near Lewiston and started gold dredging operations.

Nye County, Nevada. W. F. King and associates have launched an extensive gold placering operation in the Johnnie district.

Union of South Africa. Free State Saaiplaas Gold Mining Co. Ltd. reached production in 1960 at 50,000 tons per month.

URANIUM

Casper, Wyo. Globe Mining Co. built a 4992-tpd mill costing $3-million. Mill went into production in January.

Wyo. Green Mountain Uranium Corp. began shipment from its Fremont County mine in Feb.

Wyo. Utah Mining Corp. started production from its Shirley Basin mine in January at 100 tpd.

LEAD-ZINC-SILVER

Mullan, Idaho. Lucky Friday Silver-Lead Mines began operation of a 500-tpd mill in Feb. Cost was $800,000.

Nevada. Argentum Mining Co. & Argentum Consolidated Mines Inc.'s $1-million plant is processing 1,000 tpd silver ore from the Alpha T stripmine. Production will increase to 5,000 tpd.

Vassbo, Sweden. Boliden Mining Co. opened a 150,000 tpy mine. The $4-million mine and mill will ultimately yield 9,000 tpy of pure lead.

Kellogg, Idaho. Bunker Hill Co.'s fertilizer plant at Kellogg has started with 200,000-tpy capacity. Cost $10-million.

San Ramon, Peru. Eduardo Busso has started shipping 50% lead ore and 8-oz silver ore from its concession in the San Ramon hill country.

MISCELLANEOUS METALS

Ixtahuacan, Guatemala. Empire Industries Inc. has opened a $2-million antimony mining operation.

Sudbury, Ont. A new 6,000-tpd mill is handling nickel ore from International Nickel Co. Inc's Levack Mine. Opening of the Thompson Mine at Moak Lane, Manitoba, is next step.

Quebec. A 6-tpd lithium plant was put on-stream in Feb. by Quebec Lithium Corp.

Carteret, N.J. American Metal Climax Inc. has completed its new germanium refinery and is producing dioxide from primary raw materials and scrap. The plant also produces Ge metal.

Val d'Or area, Que. Quebec Lithium Co. Ltd. has started production of lithium carbonate from the 1000-tpd mill at its mine.

Wash. Construction of a 150-tpd tungsten ore mill began at Silver Hill.

NONMETALLIC MINERALS

Grande Isle, La. Freeport Sulphur Co.'s Frasch Sulphur mine seven miles offshore, built at a cost of $30-million began production.

Lake Pelto, La. Freeport Sulphur Co. opened its new sulphur mine.

Galveston, Texas. U.S. Sulphur Co. opened a new sulphur mine at 1,200 tpd.

Kellogg, Idaho. Bunker Hill Co.'s new $2-million phosphoric acid plant is producing 130 tpd.

Italy. Sicily's first modern, fully automated kyanite mine and processing plant, built by Montecatini, was put onstream at 2000 tpd after 8-months construction.

Houston, Tex. International Minerals & Chemical Corp. has started processing barite at its new $500,000 plant.

Franklin, Tenn. TVA will soon begin mining phosphate.

Bovill, Idaho. J. R. Simplot Co. began operations of its $1.5-million silica sand plant. Production will be 3-million 100-lb bags of clay and sand per year.

Napa, Calif. Asbestos Bonding Corp. has gone into production at its new 1,000 tpd, $1-million asbestos plant, which utilizes an air separation process.

Nevada. Eagle-Picher Co. developed a new open pit mine containing filterable grade diatomaceous earth.

Red Lodge, Mont. Multi-Mineral Products Corp. has begun production at its Red Lodge limestone quarry.

Valley, Wash. Lane Mountain Silica Co.'s new $500,000, 400-tpd processing mill will begin production in January, 1961.

Watch for Major Developments Here

MANGANESE

Minas Gerais, Brazil. Companhia Ferro Manganes de Minas Gerais —part government, part private—may be established to work the mines and manufacture 100,000 tons of alloys annually. (Initial capitalization: 500-million cruzeiros—approximately $2.7-million.)

IRON ORE

Kursk, USSR. Soviet engineers have proved a 22-billion-ton deposit.

Transvaal. Iron & Steel Corp. plans mechanization to increase pro-

ASARCO'S $43.5-million Mission project on a copper porphyry deposit southwest of Tucson, Ariz., will have mill capacity of 15,000 tpd. Western-Knapp designers.

CLEVELAND-CLIFFS IRON CO.'S $15-million Humboldt, Mich., project includes this flotation and Grate-Kiln pelletizing plant which has capacity to process 650,000 tpy.

duction to 2.3-million tpy by 1962.

Moresby Island, B.C. Westfrom Mines Ltd. is about ready to mine a 4.9-million ton deposit grading 57.3% Fe and 0.59% Cu.

Mineral Basin, Nev. U.S. Steel is doing extensive drilling on a promising deposit.

Minnesota. M. A. Hanna is building a pilot plant to test up-grading of semi-taconites.

Varennes, Que. Quebec South Shore Steel Corp. plans a Udy Process steel center by 1961 at a cost of $22-million—two electric furnaces for 150,000-tpy of pig iron.

Corral Springs, Nev. Utah Construction & Mining Co. is planning development of large deposit.

Costa Rica. International Iron Inc. discovered a high-titanium iron deposit on the west coast.

Peru. Gustavo R. Pita and Alberto P. Ramieriz have discovered an ore deposit 25 miles from the coast "similar in size and grade to Chile's El Laco deposit."

Kowkash, Ont. Can-Fer Mines Ltd. is doing development work on its 130-million ton orebody of plus 66% near Kowkash.

Augusta, Australia. A large deposit of limonite ore has been discovered by Griffin Coal Mining Co. Initial estimates claim a content of 60 to 100-million tons of ore averaging 45% Fe.

Bomvu Ridge, Swaziland. Anglo American Corp. expected to contract with Japanese ironmasters, the Yamata and the Fuji companies, to supply ore by early 1964—nearly 12-million tons of ore over a 10 year period.

Unterweser region, West Germany. Deposit discovered is comparable to Salzgitter deposits and lies at depths of 266 to 1300 ft.

Western Australia. Both Japanese and Australian experts believe that a token export quota for Western Australian iron ore will be established in the near future. The parties hope for a 5 to 10-million tpy permit.

Bomvu Ridge, Swaziland. The Swaziland Iron Ore Development Co., administered by Anglo American, has completed a survey of Bomvu Ridge iron ore deposits, and has an exclusive prospecting license covering a 2½ sq mi area.

Vancouver Island, B.C. Noranda Mines Ltd. has bought a group of iron ore claims at Maggie Lake for $1.15-million. Total deposits are expected to be well over 1-million tons.

Brazil. A group of independent miners in the Paraopeba Valley have offered to help finance re-equipment of the wide-gage Central do Brasil Railroad to facilitate ore shipments for export.

Clarkdale, Ariz. Zeckendorf Steel Co. may erect a $15-million Udy Process steel-copper-and-zinc and building-block center on the old United Verde Extension property. Copper smelter tailings will be used at 500-tpd.

COPPER

British Columbia. Lumitomo Metal Mining Co. Ltd. may put up $7.5-million for a mine and 5,000-tpd mill for Bethlehem Copper Corp. Operation would be by the fall of 1962.

Canada. Pronto Uranium Mines may mine 1-million tons of 2.1% copper from its Pater copper property.

Einasleigh District, Australia. Twenty proved mines were reopened to supply Japanese buyers.

Nevada. Kennecott Copper Corp. has filed on 110 mining claims in Mason Valley north of Yerington.

Garfield, Utah. Kennecott Copper Corp. has made plans for a $750,000 pilot plant at the Garfield smelter to test oxygen smelting.

Tucson, Ariz. Hi Jolly Mines Corp. officials hope to find a buried disseminated deposit of over 1%, with about three dollars in gold-silver per ton in Yuma County. The company has 218 claims in that area.

Britannia, B.C. A reserve of 1.4-million tons of copper-zinc ore averaging about 2% Cu is reported by Howe Sound Co.

Highland Valley, B.C. A 3,000-tpd, $7.5-million mine and mill by Bethlehem Copper Corp. Ltd. may materialize by Sept. 1962.

Southern Rhodesia. Rand Mines Ltd. has drilled a large orebody on the Shamrock Claim in the Karoi district.

Vancouver Island, B.C. In order to boost its ore reserves, Cowichan Copper Co. Ltd. is planning to gain control of four small properties: Nadira Mines, Avallin Mines, Cellardor Mines and Caycuse Copper.

Michigan. Copper Range Co. will complete shaft sinking in its Upper Peninsula copper deposit in Fall, 1961, and continue testing of the orebody to determine the feasibility of establishing a permanent operation.

Milford, Utah. Anaconda Co. has signed a multi-million-dollar long-term option to buy twelve sections of land northwest of Milford.

Arequipa, Peru. Mitsui Bussan Kaisha Ltd. has taken an option on the San Jose property. Unproved reserves are estimated between 250-million and 500-million tons of 0.6% ore or less. Mitsui also holds an option on the mine of the Cia. Minera Chapi, a few miles south of the San Jose property.

BAUXITE-ALUMINA-ALUMINUM

Australia. First shipments of Western Australian bauxite to Japan will total 30,000 tons. The government is prepared to authorize exports of about 300,000 tpy.

Greece. A Franco-Greek group has planned a $75-million, 100,000 tpy alumina plant and a $125-million power project for Greece. French aluminum producers, Pechiney and Ugine, and the Greek shipping magnate, Stavros Niarchos, are negotiating with Reynolds Metals Co., which may join the venture.

Clarendon Parish, Jamaica. Aluminum Co. of America has exercised an option covering mining rights on 30,000 acres.

GOLD

Longlac, Ont. Chesterville Mines' preliminary surface work picked up good values on a surface vein structure at points 30 ft apart.

Misima Island, Papua. A pilot plant for an extensive lode system with promising values is planned by Pacific Islands Mines Ltd.

Coronation Hill, Australia. United Uranium N.L. reports underground gold deposits of "very high values" found during uranium prospecting.

Malartic, Quebec. Three gold-bearing zones have been cut and work is progressing at the 650-ft and 800-ft levels at Marban Gold Mines' Malartic area property.

LEAD-ZINC-SILVER

Moulouya Valley, Morocco. Moroccan Mining Research Office will build a pilot filtering plant to determine the most economical treatment of lead ore from the large lead deposits in the Moulouya Valley. A $4-million processing plant will be built later.

Ross River, Yukon Territory. Ketzakey Silver Mines Ltd. has purchased 44 mineral claims. Average assays are 80 oz Ag and 30% Pb.

Peru. A Belgian consortium, Syndicat Belge d'Enterprises a l'Etranger, has proposed to build a $10-million zinc plant in Peru's Central Andes.

Tooele County, Utah. Marvel Mining Co. has discovered a high-

PERLITE from the world's largest deposit at No Agua, N.M., will be shipped to this new Johns-Manville plant at Antonito, Colo., where it will be blended and loaded.

PIT BOTTOM of Kennecott's Bingham Canyon mine is being tractor-ripped and scraped to produce a 150-ft deep spiral drop cut to connect with deep-level haulage tunnel.

grade body of lead-silver oxide ore (averaging $50 per ton) in the Clifton mining district.

Tennessee. American Zinc Co. has proved 1-million tons of lead-free zinc ore near Straw Plains.

Nevada. The newly-formed Ruby Hill Mining Co. may spend $10-million for exploration to include a potentially large deposit on Ruby Hill.

Ontario. Lun-Echo Gold Mines and Kerr-Addison Gold Mines are exploring a new discovery in the Nakina area.

Lima, Peru. A three-man German Government mission has recommended construction of a $24-million refinery.

URANIUM

Shirley Basin, Wyo. Hidden Splendor Mining Co. and Federal Resources Co. joined with Gas Hills Uranium Co. to propose a 1000-tpd mill to supply AEC with 500 tpy concentrate in the 1962-66 period.

BERYLLIUM

Topaz Mt., Utah. Beryllium claims were staked by Beryllium Resources Inc., E. I. du Pont de Nemours & Co., Food Machinery & Chemical Corp., Combined Metals Reduction Co., and Vitro Chemical Corp.

Calio, Utah. An outcrop of beryllium ore has been reported discovered on the east side of Mt. Baldy.

Glens Peak, Ida. USBM and Idaho Bureau of Mines have reported a "potentially significant" deposit of beryllium ore.

Seal Bay, Labrador. Rio Tinto Canadian Exploration has taken a working option on a property which contains an estimated 0.24% columbium pentoxide and quantities of high grade beryllium.

Sawtooth Mountain area, Idaho. Beryllium International Co. plans work to determine the extent of the original discovery and the possible extent of the granite in which the aquamarine occurs.

Lone Pine, California. White Caps Gold Mining Co. has reported a "major find" of beryl-bearing ore. Coring tests indicate extensive deposits of phenacite, together with lower-grade beryl crystal.

Topaz Mt., Utah. Beryllium Resources Inc. expects to build a small acid treatment mill near its Spor-Topaz Mt. beryllium deposit sometime in 1961.

Yellowknife, B.C. Columbia Explorations, Ltd., has uncovered a deposit of beryl extending more than 2000 ft in preliminary trenching operations.

MISCELLANEOUS METALS

Searles Lake, California. Miracle Mining Corp. may develop a large rare minerals deposit.

Araxa, Brazil. Discovery of a 7.5-million ton columbium deposit was announced by Wah Chang Co.

Athabasca, Alberta. Four companies, Imperial Oil Ltd., Cities Service Athabasca, Inc., Richfield Oil Corp. and Royalite Oil Co. Ltd. are investing in development of oil sands.

British Columbia. Consolidated Standard Mines plans to develop its Alice Arm molybdenite discovery and its lead-zinc prospect near Revelstoke.

Quebec. Falconbridge Nickel Mines has outlined more than 350,000 tons of nickel ore averaging 3.95% Ni.

Anchorage, Alaska. Glacier Creek Mining Co. is prospecting and testing on Hayes Glacier molybdenum deposits 80 miles northwest of this city.

Letaba, North-Eastern Transvaal. Consolidated Murchison Mine has intensified exploration for antimony cobbed ore and concentrates, and has acquired over 1000 claims.

Assinica Lake, Quebec. Possibilities of large lithium deposits (with some beryl) have been indicated in work completed at Sirmac Mines property.

Red River district, N.M. Molybdenum Corp. of America has discovered an estimated 260-million ton orebody, molybdenum, grading 0.25% MoS_2.

Lemhi Pass, Idaho. Rare Metals Corp. of America is selecting operable thorium claims.

Eureka, Mont. Montana Bureau of Mines and Geology reports the existence of a barite vein.

NONMETALLIC MINERALS

Khemisset area, Morocco. Moroccan Mining Research Office has discovered "enormous" potassium deposits in the Khemisset area, 40 miles east of Rabat.

Lovell, Wyo. Plans for a $5-million gypsum plant received boost when directors of Crystal Creek Gypsum Co. agreed to transfer 67 gypsum claims along the Big Horn River to a corporation to be formed soon.

Lander, Wyo. Western Nuclear Corp. has obtained an option on 8,380 acres of mica claims in the South Pass area southwest of Lander, and is conducting marketing surveys for potential development of the area.

Lovelock, Nev. Charles E. Fancher and Jake Baird have filed a claim on a large deposit of diatomaceous earth west of Lovelock. Great Lakes Carbon Co.'s Dicalite Division has shown interest in leasing the property.

Veto, Alabama. Virginia-Carolina Chemical Co., Armour Chemical, and Victor Chemical have launched phosphate prospecting operations on Elk River.

Mount Diablo, Calif. Johns-Manville has leased land containing 48 tons of asbestos.

Nevada. Nevada Clay Products Co. have drilled several million tons of good grade bentonite.

Quebec. Murray Mining Corp. is lining up a $1-million development program of its Ungava asbestos project.

El-Hassa, Jordan. Internation Minerals & Chemical Corp. offered to develop a 150-million ton deposit of phosphate either alone or with Jordan Phosphate Mining Co.

Quebec. Discovery of a 7-million ton asbestos deposit in Quebec was announced by the Minister of Mines.

GENERAL

Ghana. The U.S.S.R. has signed an agreement with the Ghanaian government by which the Soviets will provide economic and technical "cooperation." Trade agreements were also concluded.

Morocco. U.S., French and German investors have voiced interest in developing zinc, lead and graphite mines in Rif.

Iraq. Soviet mining engineers have started surveys of ore deposits in the northeastern, northern and western Iraq. The surveys will cover ferrous and nonferrous metals, sulphur and phosphate deposits.

Arizona. The Bureau of Indian Affairs and the White Mountain Apache Tribe approved Colorado Fuel and Iron Corp.'s bid for exclusive prospecting permits on eastern Arizona Apache Indian lands. Iron ore, asbestos, manganese and coal are thought to be present in the area.

UAR. The Soviet Union will provide mining experts and $4.2-million worth of equipment for geological and geophysical exploration in the Eastern Desert and Sinai Peninsula.

HIGHLIGHTING the trends in trucks are two KW Dart models that combine high-horsepower with lower weight per horsepower. Left, world's largest commercially offered truck hauls 95 tons. Right, corrugated body increases capacity two tons.

ELECTRIC-WHEEL trucks, tested at two open pit mines, will soon move to others. R. G. Le Tourneau's 75-ton "Trolley Truck" (left) and Unit Rig and Equipment Co.'s 64-ton "Lectra Haul" (right) are early forerunners of bigger models to come.

Mining Practice—Better Techniques

BERNARD R. HENDERSON

Automation, remote control and mechanization highlight the developments of 1960. With many machines, aluminum and high-strength steel are becoming increasingly important as weight-savers and cost-cutters. Revolutionary mining concepts are on the horizon and the 1960's may see remote-controlled operation of hard rock mines with such tools as the digital computer, the electrically-powered hydraulic rock breaker and the hydraulic pump for ore. Because of the rapid advance in mining technology, only a few of the important developments of the last few years are reviewed.

Open Pit Mining

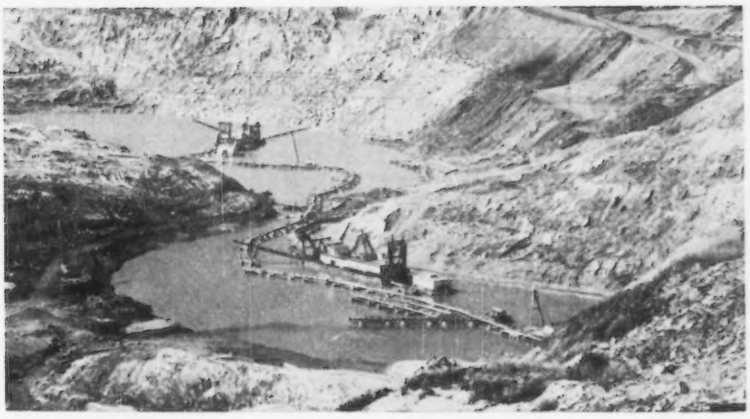
ELECTRIC WHEEL TRUCKS may revolutionize haulage. Capable of high speeds and large palyoads, the trucks can negotiate grades unattainable with diesel engines.

Because steeper grades make shorter haulage routes and a lower stripping ratio possible, a redesigned pit is the ultimate result of the new trucks.

Two models have been tested—one at M. A. Hanna's Hunner Mine, the other at Anaconda's Berkeley Pit. Hanna's truck, a 64-ton model powered by a 700-hp diesel engine, was built by Unit Rig & Equipment Co. Anaconda's 75-ton giant, built by the R. G. Le Tourneau Co., can take a 15% grade at 12 mph.

Power is supplied to Hanna's "Lectra-Haul" drive motors, centered in each of four wheels, through a generator. With Anaconda's "Trolley Truck," power comes through an overhead trolley or, if desired, through an engine-driven generator.

Here are some additional advantages of the electric wheels: (1) Elimination of transmissions, clutches and differentials, (2) elimination of springs by the use of large tubeless tires, (3) simplified electric steering, (4) regenerative braking to return power to the line where possible or advisable and (5) elimination of tire spinning.



SEVERAL million tons of overburden were removed last year by hydraulic dredges, including those at Caland's Steep Rock Lake project (above) and in Surinam.

ONE of the world's longest conveyor systems (7½ miles) consists of thirteen 24-in. conveyor belts which move iron downhill from Mina Carmen to Chanaral, Chile.

From Better Equipment

Rapid acceptance by the industry is indicated, for example, by Anaconda's plans to introduce electric wheel haulage at three of its operations, including Chuquicamata. At Chuqui, plans are underway to supplement the present diesel-electric rail haulage with the trucks and to use them for developing new ore benches.

Back at the Berkeley Pit, an independent contractor is now testing a model called the "Electro Truck." And the Le Tourneau Co. has put the electric wheel on a new 30-ton scraper. Chief advantage of the new scraper is an increase in tractive potential of its four drive wheels.

The introduction of these models is only a taste of what is to come. The "Lectra Haul," for example, has provisions for an increase from the present 700 hp to 1800 hp. A new 29-in. G.E. motorized-wheel unit has a capacity of 100 hp per wheel.

Other key developments in trucks include Inco's Allison gas-turbine engine, the mammoth 175-ton truck at Bingham (built by Western Contracting Co.), Canadian Johns-Manville's aluminum-body truck at Asbestos, Que. and Anaconda's corrugated-steel-body truck at Weed Heights, Nev.

A basic principle common to all the above developments is the reduction of weight. For the same hp, decreased truck weight gives increased payload.

Bingham's 175-ton truck, for example, was constructed with T-1 steel, a high-strength material that allows thinner and consequently lighter bodies. Similar steels were used in the construction of the electric-wheel and other new, large-sized trucks.

The aluminum body and corrugated-steel body are modifications of KW-Dart dump trucks. At both operations these modifications allowed substantial increase in payload. For example, Anaconda's corrugated-steel body allowed an increase of 7-yards payload per truck cycle.

One of the advantages of the gas turbine engine is that it delivers 70% more power per lb engine weight. This advantage and the ability of the engine to start at temperatures as low as —65° F make the engine ideally suited to Inco's Sudbury operations.

Practically all of the manufacturers have introduced bigger trucks. One innovation to this size growth is Differential Co.'s Wagon Train on Rubber, a series of trailers hauled by a single engine. Along with the power growth, the manufacturers are making wider use of high-strength steels and have improved performance of components.

New Tires Ahead

Since tires account for 30% of haulage cost, operators are looking for new tires and ways to improve their performance. Usually this is a matter of tire-education, i.e. recognizing the danger of overloading, speeding, poor haulage roads, etc.—factors which cause overheating as well as cutting and rupturing.

Recently a new tire has been marketed that shows promise of beating the heat problem. In it, a single ply of steel wire or several nylon plies are embedded in the carcass and aligned so that the strands are at right angles to the circumferences of the tire. In the undertread, steel cables are aligned in the direction of rotation.

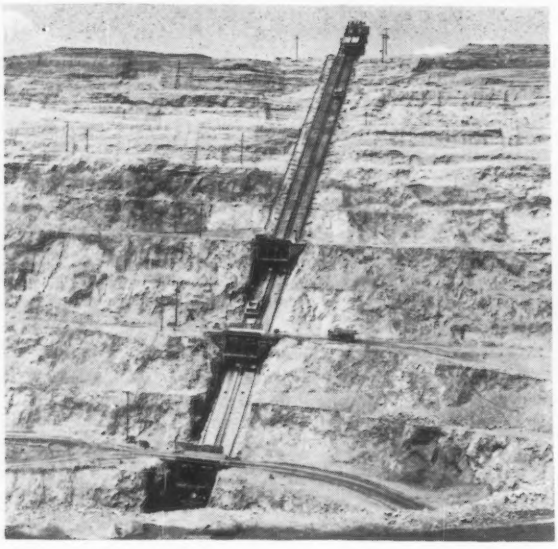
Briefly, the trend in trucks is along the following lines:

1. Increased size and power
2. Increased payload to truck weight ratio
3. More heat-resistant tires
4. New-type power plants
5. Improved controls and components

If developments of the last year are any indication of developments to come, the 1960's may see direct application of some of the new-type power plants to trucks. (See "Revolution in Power," EM&J, June 1960).

Power plants such as the fuel-cell, Caterpillar's turbocharged gasoline engine, Deutz's air-cooled diesels and NSU Werke's rotary single-piston engine show definite promise. Along with the new engines, hydrostatic and electro-magnetic drives may appear on trucks of the future, if the trend is not entirely to electric wheels.

Machine weight reduction, important to the new trucks, is also useful for shovels and railroad cars. Many



BUCKET-WHEEL excavators have high tonnage capabilities, with digging abilities about the same as a power shovel.

SKIP at Liberty Pit enabled Kennecott to reduce fleet requirements by 50%. Capacity is about 1000 tons per hour.

operators are reported to have changed or are planning to change to T-1 or similar steels for shovel dippers. The lighter-weight dipper can deliver a larger payload to the haulage unit. Alcoa's new all-aluminum dipper, built by Electric Steel Foundry Co., carries 22% more bauxite per dipper load at their Dominican Republic operations.

In a West Virginia coal mine, a welded aluminum mine car which weights 50% less than steel cars is undergoing operational tests.

Drilling, Ripping & Blasting

A significant advance in open pit drills is the introduction of Joy Mfg. Co.'s inclined rotary. Capable of drilling vertically or 30° from vertical, the new drill makes possible angle-face blasting of benches. Angle-face blasting is reported to result in lower cost, better fragmentation and more stable banks.

An innovation to drilling—the addition of detergents to water—gives the following advantages: (1) Faster rotation under maximum pressure with an estimated increase in penetration of 10% (2) increase in life of retipped bits of from 400 to 500 ft, and (3) improved dust control with lower water consumption. At Silver Bell, daily cost of the detergent (1½ lb per 100 gal water) for all drills is reported to be about 40¢.

The old workhorse, the churn drill, is still performing well in some hard rock formations. However, the trend continues towards rotary and down-the-hole percussive drills, with the latter favored for harder rock.

Jet piercing, already popular on ultra-hard Mesabi ores, is making headway in the quarrying industry. Union Carbide Corp. has demonstrated a jet-piercing rig that cuts channels in granite quarries, giving an attractive texture to the granite surfaces.

Wagon drills are becoming more flexible and easier to handle. CP's G-900 Trackdrill, for instance, can drill 4-in. or 4½-in. holes at right angles to the track and up to 11 ft overhead.

Ripping, a method considered cheaper than drilling and blasting, received a shot in the arm when Morrison-Knudsen Co. decided to rip the bottom of the Bingham Pit. In making Kennecott's new 150-ft spiral drop cut, M-K will remove some 5-million tons of ore. Significantly, the new cut will be made about three times as fast as the old method would allow. Equally important is the fact that the new spiral is proving ripping to be a valuable mining tool deep in the pit as well as on the surface.

Three developments are speeding the use of ripping: (1) Bigger, more powerful tractors; (2) tougher rippers; and (3) fast, seismic analysis of rocks to determine their rippability.

Conceivably, rippers could be used in combination with electric-wheel scrapers to combine the advantages of cheap fragmentation with high-speed, steep-grade transportation. Not only would this method be flexible, it would allow the same redesign of open pits as the electric-wheel truck, with the resultant lower stripping ratio.

With ammonium nitrate firmly entrenched in blasting, blasters are looking for methods to increase performance of the explosive. Due to increased density, AN/TNT/water slurries have proved successful at Iron Ore Co. of Canada in allowing a 100% increase in hole spacing. They could have allowed a smaller drill hole with the same spacing.

Although the factory-mixed slurry is about as expensive as dynamite, it is water-compatible and can be bulk-handled.

Other slurries such as AN/molasses/water and AN/sugar/water are useful for increasing density and have been successfully used in 2-in. holes in Australia. Another way to increase density is to mix prills of different sizes together, although the resulting densities are much lower than slurries.

Manufacturers, meanwhile, are developing prills with shapes that allow greater densities, and coatings that allow more uniform distribution of fuel oil, as well as pre-mixes with carbonaceous sensitizers other than fuel-oil. In the pre-mix field, Du Pont has recently introduced a nitro-carbo-nitrate explosive suitable for blasting 2-in. holes and giving performance equal to 60% extra dynamite.

Theoretical Considerations

Carbonaceous ammonium-nitrate mixes are conventionally compared to other explosives by relating their detonation velocities; i.e. the greater the velocity, the more energy is available for spalling. Spencer Chemical Co., however, has cast some doubt on the validity of this comparison.

Spencer points out that there are

actually two kinds of energy that do useful work in breaking rock: (1) Thrust energy, which is related to gas expansion, and (2) shock energy, which is related to detonation velocity. For hard rock, shock energy is more important; for soft rock, thrust energy is more important.

Because carbonaceous AN mixes have a gas expansion greater than other commercial explosives, Spencer's theory explains why the mixes perform better than theoretical calculations based on velocity indicate. The blaster, therefore, can expect AN mixes to outperform dynamite in soft formations.

Bulk handling has proved one of the chief assets of AN. In this field the methods and innovations are numerous. Specially-designed trucks, pneumatic loaders, concrete mixers, under-the-track augers for unloading, bucket elevators, gravity feed bins and other devices are used. Operators, who use other than wooden containers, may prevent corrosion by coating the surfaces with epoxy resin or fibreglass.

Although the primary purpose of blasting is to provide a material that can be shoveled into a haulage unit, it is equally important that the material be easily handled. Results of surveys and observations by E&MJ clearly show that the highest shovel tonnages are obtained in pits where fragmentation is the best, with all other factors being secondary.

At these high-tonnage-per-shovel-shift operations, hole spacing is close and powder consumption high. However, markedly increased production more than offsets the increased drilling and blasting costs. An added advantage at some operations is the elimination of secondary blasting.

In the field of secondary blasting, tests made by the Colorado School of Mines have shown that effective boulder fragmentation can be obtained by mudcapping with AN-fuel oil mixes, thus eliminating the need for drilling. At Columbia-Geneva's Iron Mountain mine, a 50-50 mixture of AN and Composition B is placed behind a ball of Detacord in the hole —thus, the need for the electric cap and dynamite primer is eliminated.

Because of the intense and accelerated research in explosives, some manufacturers have indicated that they are on the verge of marketing significantly better explosives. Dow Chemical Co. recently demonstrated a "metallized-system" explosive that broke 15,000 cu yd of hard, cherty taconite by placing 4000 lb explosive in four 10-in. holes, 45 ft apart. Fragmentation was reported excellent.

Skips

Using the most direct route from pit bottom to pit top, Kennecott's Liberty Pit became the second western copper producer to install a Rockover skip system. A third is underway at Chino.

Along with reducing fleet requirements by more than 50%, Kennecott's skip also offers the following advantages: (1) Reduced stripping ratio by eliminating many haulage roads, (2) elimination of railroad bench and haulage road maintenance, (3) flexibility in planning the mining sequence, (4) lower pit equipment capital and maintenance costs, (5) minimizing ore car maintenance on the pit-reduction plant rail haul due to decreased loading damage as well as to an improved load factor, and (6) increased productivity.

Operators who have considered and rejected skip installations at properties amenable to skips have done so because of the high initial cost (about $2-million for the installation) and the low load capacity of the skips (25 tons at the Liberty Pit) as well as to the fear of having all haulage tied up in a single piece of equipment.

On balance, then, it appears that a fairly careful analysis of individual properties on a long-term basis is necessary to justify a skip installation.

Conveyors

Belt conveyors in the pit received impetus with the installation of a 1300-ft, 18°-inclined conveyor in U.S. Borax's Boron Pit.

The belt, offering a two-to-one economy over truck haulage, was selected after detailed study of various haulage methods. The company estimates that by 1980 truck haulage would cost 56¢ per ton, as opposed to 27½¢ per ton for the conveyor.

Two new conveyors are capable of moving ore up inclines as high as 45°—LMG's sandwich conveyor and a German chain mat conveyor to be manufactured in Britain by Richard Sutcliffe Ltd.

Both conveyors have cover belts to hold ore onto the carrying surface. However, the sandwich conveyor uses an upper rubber belt with pressure rollers, compared to an endless upper belt of heavy flexible chain matting for Sutcliffe's conveyor.

Possible applications of the new conveyors would be in deep pits, where increased stripping ratios would prohibit continuing them as open pit mines.

Another important advance in conveyor design is the Stubbe Serpentix conveyor. This amazingly flexible conveyor can operate at a 72° angle of inclination and turn in an arc of 25 ft at the same time. This flexibility, plus the fact that the conveyor is portable, means an operator could place it anywhere in the pit and move it at will.

Essential feature of the conveyor is a specially designed rubber belt with molded projections. At present, the conveyor is being demonstrated in Johannesburg, South Africa.

Bucket Wheel Excavators

The most spectacular of all mining machines, the bucket-wheel excavator, is making further inroads in scattered areas around the world. Since 1936, Orenstein-Koppel und Lubecker Maschinenbau AG has built 69 machines, with three more under construction. Fried. Krupp Maschinen- und Stahlbau Rheinhausen reports use of their excavators in five continents.

With capacities up to 13,000 cu yd per hour, chief use of the machines is for overburden removal, coal and soft ores. Because their digging ability is equal to that of a shovel, they can be used in any formation where shovels dig without the aid of blasting (although consolidated sandstone requiring light blasting was excavated by a machine in India).

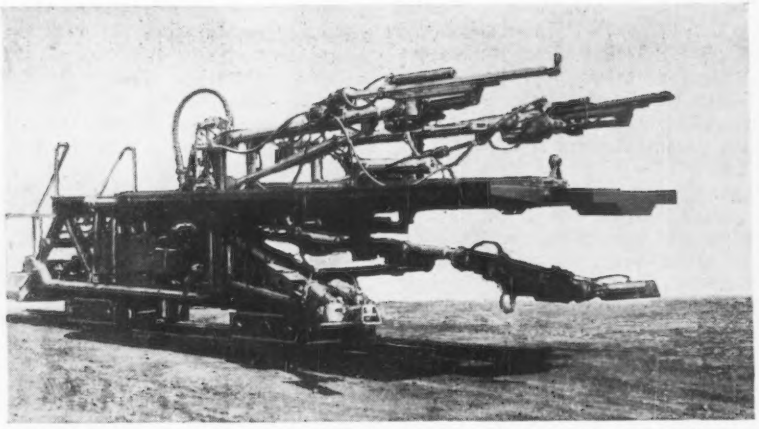
Because of the large capital investment required and the limited range of their usefulness, bucket wheel excavators are practical only where large tonnages are to be removed over a long period of time. However, where they are practical, their long-term cost compares favorably with other mining methods and, certainly, nothing approaches them for tonnage capabilities.

Dredges

Several million tons of overburden were removed last year by dredges, including those at Steep Rock Lake, Black Lake, and Paranam, Caland Ore

At Steep Rock Lake, Caland Ore Co. Ltd. put its iron pit into operation, after disposing of over 165-million tons of silt by a pair of 36-in. hydraulic pipeline dredges in five years. At the latter operation, begun in 1957, Suriname Aluminum Co. is operating a 24-in. suction-cutter dredge to remove overburden from an aluminum deposit.

Although cost of dredging at Paranam is 19.62c a cu yd (higher than scrapers or draglines), dredging proved to be the only practical method of removing the soft impervious clays found there.



THIESS BROS., Australia, made a 526-ft advance in six days with a green 22-man crew by using this specially designed drill jumbo. Center drill makes 5-in. holes.

ALIMAK raise climbers offer safety, speed and low cost in various mines.

Underground Mining

Originally designed to improve safety, raise climbers are proving to be production-boosters and cost-cutters. Since their introduction in 1957 by the Alimak Co. of Sweden, they have been accepted in mining operations throughout the world.

In one of their toughest tests to date—at the Steward mine in Butte, where high-temperature, high-humidity, heavy ground conditions prevail —they have speeded raising 58% and cut costs 33% when compared to timbered raises. By using the Alimak at Shattuck Denn's Iron King mine, company time shifts were cut in half, raises completed 2.4 times faster, ventilating time eliminated, and $1200 worth of timber saved in each 142-ft raise when compared to timbered raises. Additional results at Iron King were the elimination of the tramming crew needed to pull the raise chutes and the cutting of the bonus contract shifts required to complete a raise to 64% of those necessary for timbered raises.

Raise climbers are manufactured by the Alimak Co. and by Joy Mfg. Co. Joy's climbers are presently undergoing operational tests at several U.S. mines and are expected to be on the market soon.

Also from Sweden comes word of a rope-suspended raise platform that contains its own hoisting machinery.

Aside from the newer raising methods such as raising by long-holes or with a steel ladder platform, where local conditions dictate their practicability, progress is being made in the use of large boreholes for raises.

In Germany, 32-in. dia boreholes are used for ventilation, drainage, pipelines, emergency exits and for lowering supplies. Essentially a soft-rock operation, up to 800-ft-long raises have been drilled. The method consists of overhand drilling an 8-in. dia hole with a tricone bit, then enlarging the hole to 12-in. with a rolling type reamer bit from the surface down. A coupled combination of 16-in., 24-in. and 32-in. rolling reamer bits makes the final enlargement. In Germany, costs vary from $14.00 to $28.00 per ft.

In the U.S., Olga Coal Co. reports a rotary drilling method making use of Hughes cutting bits mounted on a special powered barrel. In their latest project, Olga drilled a 76-in. dia hole 698 ft deep in 47 days at a cost of $104.50 per ft.

The hole was started by drilling a 12½-in. pilot hole from the surface, which was then reamed to 22 in., and finally to 76 in. by a modified rotary oil drill rig.

However, the latest and perhaps the most significant project as far as hard rock men are concerned is Moran Bros. Inc.'s project at the AEC's Nevada Test Site. Moran Bros. are drilling a 44-in. dia hole through 965 ft of solid granite with a modified rotary oil rig. Cost of the project is estimated to be about $250,000, with the methods similar to Olga's.

Drilling and Blasting

The basic hole-puncher, the airleg, was improved upon by manufacturers. Along with easier-handling controls, some models now feature both power-retracted legs and telescopic legs. New models with larger bores and longer strokes were introduced that are capable of faster penetration.

Not only has the airleg replaced the Leyner, it also has replaced the jumbo in some operations. International Nickel, for example, got better results by using airlegs on a platform-mounted truck than by using jumbos. Chief advantage of the airleg-truck system is that maintenance and delays are virtually eliminated since a drill can be quickly replaced.

The trend in jumbos is towards remote control. St. Joseph Lead Co., for example, has new drill jumbos with two out of three drills operated by remote control from the tractor seat.

For large drifts and tunnels, several jumbos have been made for drilling large unloaded center holes in a burn cut round. A remote-controlled five-drill jumbo of this type allowed the Australian firm of Thiess Bros. Pty. Ltd. to make a 526-ft advance through granite in six days with a green 22-man crew. The average advance per round in the 12.5 x 12.5-ft tunnel was 11.5 ft.

Thiess Bros. found the best drill pattern to be a combination of two 5-in. center holes, 11.5-ft deep with thirty-four 1⅝-in. blast holes. Besides being easier to drill, this type round gives better fragmentation, lower powder consumption and leaves the muck closer to the face.

In Sweden, the Malmberget mine employs a three-drill combine that makes a 4-in. center hole and 1¼-in. parallel holes. Although the feed

COROMANT CUT gives long drift advance with airleg drills and template.

ROBBINS Mechanical Mole gives rapid advance in soft rock formations.

length is 20 ft., the most economic rate of advance per round amounts to about 13 ft.

For small drifts, the unloaded-center-hole burn cut is being re-emphasized. Using airleg drills, a large center slot can by made by drilling two 2¼-in. holes close together with the aid of a template. (Coromant cut). Although the drilling time is increased, longer rounds (over 8 ft.) are made possible. In fact, advances of up to 13 ft have been made at the Bodas mine of Sandvik Steel Works Co. Ltd., Sweden, where the method was tested.

In addition to the advantages which are applicable for all cylinder cuts (Sandvik's term for unloaded-center-hole burn cuts), the Coromant cut is reported to have the following additional advantages: (1) Airleg rock drills of one type can be used throughout, (2) a comparatively cheap supplementary outfit, (3) unskilled drillers can obtain satisfactory drilling precision with the aid of the drilling template, and (4) blasting towards a slot is more efficient than blasting towards a round hole with the same cross-sectional area.

After extensive testing, Sandvik has come up with a strong case for cylinder cuts and has listed the following advantages.

1. Possibility of longer advance per round in small cross-sectional areas. As a rule, this implies more rapid drifting.

2. A higher advance per round in percent of the hole depth.

3. A simple drilling pattern which can be used without alteration for various advances per round and also for various types of rock.

4. The advance can be planned to suit the working cycle without the need for changing the drilling pattern. In this way, the whole shift time can be effectively employed.

5. The whole charge can be blasted with satisfactory safety at one time after the personnel have been trained. This means shorter working time.

6. Better fragmentation, which means increased mucking capacity.

7. Less throw of blasted rock.

8. Better possibility to rationalize drilling operation due to the parallel holes.

On the other hand, cylinder cuts are more costly to drill—they require expensive drills, bits and steel and consume more air. Also, they are not particularly advantageous for extra large faces.

Research and Hole Size

Research men are working on multiple-drill jumbos that will be capable of drilling an entire round in about the same time as one hole is now drilled. Besides giving extra speed, those jumbos should cost less and be easier to maintain than power jumbos.

Generally speaking, the smaller the drill-hole, the faster the rate of penetration for any given rock drill. In this respect, International Nickel found that their optimum hole size was 1.26 in. for airleg drills. The holes were made by using ⅞-in. hexagonal insert steel and 1-in. powder.

When Inco tried reducing hole size to 1.02 in. by using ¾-in. hexagonal steel and ¾-in. powder, they found that they had excessive rod breakage, higher explosive costs and more holes needed for proper fragmentation. The increased penetration rate was offset by the greater number of holes needed.

However, Delnite Mines of Canada reports considerable cost reduction by switching to ¾-in. hexagonal steel with a 1-in. bit from ⅞-in. steel and 1¼-in. bits. It appears, therefore, that rock hardness is the controlling factor of hole size.

Hecla Mining Co. also reports good results with small diameter holes. By drilling a 1-in. hole with ¾-in. integral drill steel, loading the hole with ⅞ x 16-in. low-velocity powder, and initiating it with millisecond delay electric blasting caps, Hecla found they were not only able to increase penetration speed from three to four times but they were also able to reduce the number of holes they needed by 20%.

If new high-strength, workable steel can by developed and new denser, more powerful explosives become available, significant reduction in hole size will be possible. Considerable research is being done in this field.

Rotary-percussive drilling has proved dissappointing in hard-rock mines, although good drilling results have been obtained in soft- and medium-rock mines. Recently, Gardner-Denver marketed a drill which may prove to be a good all-round machine in mines with a variety of rock types. The drill is selective; it gives rotation without impact, impact without rotation, or impact and rotation combined.

Modifications to long-hole drills include increased power and better setups to allow increased rod lengths. A Russian long-hole drill, called the "In-hole Perforator," makes use of the "down-the-hole" principal. Drilling is done by a simple pneumatic hammer-drill at the face of the hole while rotation is provided by an electric motor on the outside. Capable of drilling in any direction, the drill makes a 4-in. hole and can go to depths of 165 ft.

Also from Russia comes word of a hard-rock continuous miner currently under development. The proposed machine would make use of the method of electrically-powered hydraulic ramming with cavitation effects, a method studied in the U.S. by Allis-Chalmers since 1952.

By releasing a high-voltage (100,000 v) spark under water at high frequencies (10^6 to 10^7 per second), water is displaced—similar to displacement of air by lightning. Thus, a hydraulic blow, coupled with cavitation effects (produced when water refills the spark space), is achieved for breaking rock. Efficiency, however, is reported to be low.

Ammonium nitrate continues to move underground. The Detroit Salt mine achieved exceptionally good re-

LIBU three-way dump bucket makes possible a substantially reduced cycle time and is practical in tight underground areas.

YIELDABLE ARCHES are increasing in importance in various mines. They are safe and can be recovered and re-used.

sults by pneumatically loading an AN/fuel oil mixture in 2½-in. holes. Not only were their costs much less, but their fragmentation was better. The Colorado School of Mines reports good results from a similar mix in hard rock.

In Sweden, the underground use of AN is widespread with 1¼-in. holes, 50- to 70-ft deep successfully detonated.

Some mines are experimenting with AN/TNT/water slurries, such as those used by the Iron Ore Co. on the surface. Because of the slurries density and water compatibility, they are expected to perform well.

With better short-delay caps now available as well as precisely-timed regular delays, blasters can expect better results. With Du Pont's new precisely-timed regular delays, all caps of any given period will fire before any cap of the next period, so that there is no overlapping. Blasters report better fragmentation in virtually every operation in which it has been tried as well as better control of overbreak.

Stemming, a practice regarded as a nuisance by many operators, probably deserves a second look. Stemming guns and water-filled PVC cartridges are giving many European mines convenient stemming. Chief results of stemming are better fragmentation, lower powder consumption and lower quantities of gas and dust produced.

Loading and Hauling

Remote control has been adapted to both the Rockershovel and the slusher. At the Marquez mine, Calumet & Hecla made a remote-control box for an Eimco 630 electric loader in order to muck unsafe areas without exposing personnel during the retreat phase of mining.

Because the operator is 50 to 75 ft from the loading area, expensive support around the pillar area can be avoided. The company can recover otherwise lost ore and can blast 800 tons or more with the opportunity to safely recover the greater portion of the ore.

In Russia, a triple-drum, remote-controlled slusher is extensively used. By using three drums (one main and two tail ropes or two main and one tail rope), the scraper can be moved along curved paths and around corners. The operator positions himself where he can see the entire operation and works the slusher by remote-control. Levers are worked electromagnetically, electrohydraulically or electropneumatically.

Introduced several years ago, the Libu three-way dump bucket will be offered commercially in Australia and the U.S. in 1961, as well as in Sweden and England. An adaption to front-end loaders, the bucket dumps to either side as well as forward. Thus, a substantially reduced cycle time is possible.

At St. Patrick's Copper Mines in Canada, about 4000 tpd are loaded by seven Libus mounted on various Cats. Thirty-ton-payload Atheys and 15-ton Euclid Wagons haul the ore from the pillar stopes. Production rates are quite high for this low-capital-investment machine. One contractor in Scotland loaded 2600 tons of surface dirt in 10 hours with a Libu mounted on a Cat. 977 series E Traxcavator.

With the wide variety of loading and haulage equipment available, trends are difficult to spot. Where practical, the small shovel and truck haulage offers low cost, with electric-trucks preferred to diesels. The Crestmore limestone mine, for example, carried about 50% more rock in about half the time required by diesel trucks. Besides being cheaper to operate, the electric trucks reduced the ventilation problem at the mine.

Transloaders are reportedly giving better performance than the Gismos they were designed to replace. Their production is better and maintenance costs lower. In fact, AS&R's Grandview mine got about double their tons per hour mucking factor with maintenance expected to run about 11¢ per ton for the life of the machine.

Diesel power underground is increasing in importance with a wide variety of low trucks and shuttle cars available from manufacturers. A similar trend can be noted with conveyor belts. Where practical, conveyor belts are the cheapest of all transportation methods. A good illustration is the conveyors installed along Denison Mines' low, gently dipping beds.

In coal mining, where conveyor belts are often practical, the ropeframe conveyor, developed some five years ago, now is the most widely used. Offering a one-third reduction in initial cost, they are easily erected and easily extended. An additional advantage of ropeframe conveyors is that they occupy only about one-third as much space as conventional conveyors.

Improvements in track haulage, still one of the lowest-cost transportation methods for many mines, include telluride-type ore cars for sticky ores and conveyor-loaders for loading in drifts. C. S. Card telluride-type ore cars have proved themselves in the Ambrosia Lake mining area of New Mexico.

Canadian Refractories Ltd. built a conveyor-loader for their mine at Kilmar, Que., that is suspended on an overhead monorail. The frame for the 36-in. belt was made from 2-in. pipe, laced and crossbraced with 1-in. pipe.

Ore is mucked with an Eimco 21 mucking machine into a loading hopper which feeds the belt. Discharge is into three-ton Granby cars with loading times varying from one-half hour to one hour per train.

The Coeur d'Alene Trainloader gained in favor in Canada with installations at Madison Red Lake and elsewhere.

The Trainloader is equipped with a scraper to slush ore from the lead car to the rear car of a convoy. Ore is loaded on the lead car with a mucking machine.

Intensive research is being conducted with regard to the hydraulic pumping of ore. Commercial hydraulic pumping of coal is already reported in the U.S., Russia, China and New Zealand, and in the U.S., gilsonite has been hydraulically mined and pumped at Bonanza, Utah, for more than three years.

One hard rock development is under way in Switzerland, where large surface pumps circulate water throughout the mine. About 130 tph of broken rock are returned with the water through 10-in. mains. Although good fragmentation is a requirement, the method provides continuous transportation with a simplified shaft layout.

Hoisting

Full and semi-automatic hoisting is becoming standard practice, with the emphasis now on static controls such as transistors and magnetic amplifiers. Along with static control, remote control (with the aid of TV cameras, radio communication to a receiver on top of the shaft, or electrical communication by means of a trailing cable fastened onto the skips) is being rapidly developed. Denison Mines, for example, controls skip movement with push buttons from the levels.

In the U.S., AS&R's Galena mine is experimenting with copper cores in their hoist rope and may develop this as a direct communications method for signaling the hoistman from a moving skip. Galena also improved hoisting by installing a TV camera, a re-designed, light-weight skip and by improving rope lubrication methods.

In England, static mercury-arc converters are replacing Ward Leonard motor-generator sets in a few mines. Because mercury-arc equipment has all the inherent characteristics of a dc motor for economic speed control, it can be considered a suitable alternative to the m-g sets in a Ward Leonard system.

An extension of these developments in the 1960's will probably be the use of electronic computers to coordinate and control all mine haulage.

Other improvements in hoisting practice include the use of aluminum and high-strength steel for skips. Machet Engineering Works built three aluminum and steel skips for a Witwatersrand gold mine that saves about a ton of weight per skip. About 1.4 tons of steel and half a ton of aluminum go to make up each skip. Besides light weight, Machet claims high strength and good corrosion resistance for the skips.

The Galena mine beat the skip weight problem by redesigning the skip and by using alloy plate wherever advantageous. Galena's skips also have an improved dumping mechanism that eliminates spillage of flyrock.

A fully-automatic, 9000-hp skip was delivered to Russia by Asea, Sweden, that is capable of hoisting from 4000 ft. Capacity of each skip (double hoist system) is 50 tons and rope speed is 33 ft per second. Power is supplied by four motors and eight ropes hold the skips.

An illustration of the continuing trend to Koepe friction-type drum hoists is Inland Steel Co.'s conversion at the Bristol mine. Besides increasing hoisting capacity 35%, the converted Bristol mine hoists now reach 250 ft deeper—to the 1900-ft level. Cost of the conversion was about $100,000.

Shaft Sinking

In shaft-sinking, the trend is to circular, concrete-lined shafts. In South Africa, shafts are now being sunk at fantastic speeds, with a record 1106 ft per month set in October 1960 at Hartebeestfontein mine in the Western Transvaal. In the Orange Free State goldfields, the President Steyn mine shaft sinkers have twice surpassed 1000 ft per month. Although mechanization accounts for part of the good performance, teamwork and advance planning are credited with most of the good results.

Pneumatic and hydraulic grabs are used in South Africa for mucking. From Sweden, Alimak offers an interesting shaft-mucker, which is a raise-climber in reverse. The grab is fitted on an elevator, which moves on a monorail bolted to the side.

Cement-grouting, chemical-grouting, freezing-sinking and tubbing are all recognized ways of getting through wet, loose formations, with tubbing the only practical method for some small-particle, high-water-flow formations. Where practical, cement-grouting is the cheapest, but the fast gel time of chemical grout (as low as five seconds) makes it advantageous for some small-particle formations. International Minerals & Chemicals Corp. is presently combining freezing-sinking with tubbing to reach what is called the world's largest potash deposit at Esterhazy, Sask.

Shaft-sinking through unconsolidated formations by rotary drilling rigs equipped with reamers is proving effective, both for low cost and for speed. One Belgian mine drilled over 1100 ft of shaft in three weeks with this method.

Support

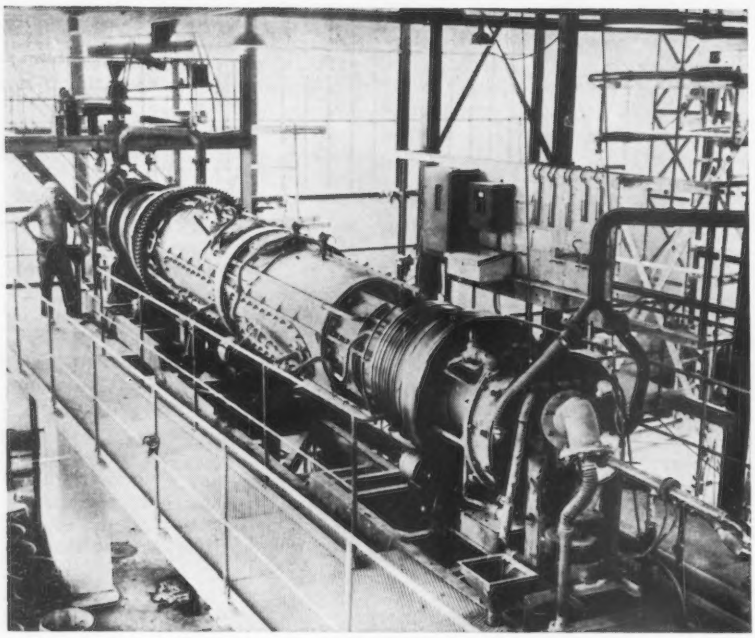
In order to prevent roof settlement and caving when replacing rock pillars, St. Joseph Lead Co. developed a new-type concrete pillar. By preloading and prestressing the pillar, settlement of the roof is minimized. Although comparatively expensive, these pillars adequately safeguard important installations.

The use of ⅝-in. expansion shell rock bolts in short time stopes is an important cost-cutter for many mines. The smaller roof bolt has only recently been offered commercially by U.S. manufacturers and is made possible by high-strength steel. A washer tension-indicator is also on the market that tells the miner when the bolts are in danger of failing or when the load on the bolt falls off.

Many operators are finding hydraulic props and yieldable arches advantageous for heavy ground. Besides adding greater safety, the steel supports can be recovered and re-used elsewhere in the mine.

Constant research is being conducted by mining companies, manufacturers and universities, especially in the field of rock mechanics, drilling and blasting. Mining is fast moving from an art to a science, although scientific mining still depends on a full knowledge of individual operations.

Possibly, with the aid of the digital computer, the wealth of data available can be summarized and analyzed to provide a more comprehensive working knowledge of mining in general. The versatile computer is already proving itself in cost analysis, maintenance, surveying and ore reserve calculations.



LURGI KILN will be heart of two new pilot plants announced by Oliver, Hanna, to attack vast Mesabi semitaconite deposits by magnetizing reduction roasting.

Processing 1960—More Instruments & Controls

The most important thing happening in metallurgical plants is the drive of instrumentation and control into more and more plants. This was a trend in the past and will continue in the future.

A most important development in control was the "Quantrol" system that Anaconda installed in its Anaconda, Mont., copper concentrator (E&MJ, August 1960, p 19 and MINING CONGRESS JOURNAL, June 1960, p 82). The system assays mill slurries so fast that the operator can do something about it right away if something is going wrong. It is an X-ray fluorescence technique, like those that many assay laboratories already use.

Anaconda's metallurgists installed it in their plant and arranged piping so as to feed samples to it from final tailings, final concentrate, and scavenger tailings pulp flows. They had to do considerable experimenting and altering to make sure of an accurate and reproducible sample every time. Once the system was set up, they could get a virtually continuous record of one product, or alternate between several products. The system needs only one minute for flushing out such different products as final concentrates and final tails and can give a new assay every 2½ minutes.

The Quantrol unit that Anaconda installed is made by Applied Research Laboratories, Glendale, Calif., but other manufacturers make similar units. One, for instance, is General Electric, whose XEG unit, which monitors up to five elements, has been on the market since late 1959.

Thickeners are being automated. In the Marmora plant of Marmoraton Mining Co., a Bethlehem subsidiary (MINING ENGINEERING, September 1960), where the product of the magnetic concentrator is thickened and filtered before going to the pelletizer, both feed and underflow rates of the thickener are automatically controlled. An air probe senses the depth in the thickener and transmits a high-level signal to a control instrument, which causes a pinch valve in the feed line to constrict, and the excess flow is caused to flow to storage pits. When new feed is deficient and pit-stored material must be reclaimed, the material is fed by an apron feeder to repulpers and then to the thickener. The probe-control governs the speed of the apron feeder to keep the flow in balance.

A similar air probe-control system in the sump feeding the pumps to the filters controls the rate of withdrawing thickener underflow. This has the effect that when the filter operator sets a filter feed rate manually, to match pelletizer demand, it automatically brings the feed-material rate reaching the pump sump into balance, so that no buildup or depletion results.

At the new water reclamation project of Kennecott's Ray Mines Division, Hayden, Ariz., "Accuray" controllers, utilizing radioisotopes, automatically control the density of the thickener-underflow slurry that is sent to the tailings pond.

An important advance that has been installed in some mills is an automatic time-modulated reagent-control valve, made by Industrial Physics & Electronics Co. It is particularly appropriate for lime or other slurries that tend to settle in lines or to plug openings. The principle is to achieve a small over-all flow rate by having a heavy flow rate for small regular intervals of time. If in a ten-second interval the valve is wide open for one second and closed for nine, the effect is a flow rate of one-tenth of full flow. Since material flows hard when it does flow, it does not have a chance to settle, nor is it likely to plug the lines. By varying the fraction of the time cycle that the valve is open, one can vary the effective flow rate of the reagent.

TV Enters Processing Plants

Closed-circuit television has entered the mineral processing plant. As R. G. Patterson of California Portland Cement Co. reported at the AMC Las Vegas meeting, closed-circuit TV extends the operators's vision throughout the plant; thus it is an important step toward centralized plant control.

For example, TV lets the operator view continuously the formation of clinker within a cement kiln. The operator who can watch the process at all times by glancing at a screen, can control it better than can a roving operator taking intermittent peeks. Other pyrometallurgical operations may eventually benefit from continuous observation in this way, such as the smelting operation in a reverberatory furnace.

As cheaper instruments have entered the market, the analytical technique of infrared spectrophotometry has come within the reach of smaller operators (E&MJ July 1960). Simple

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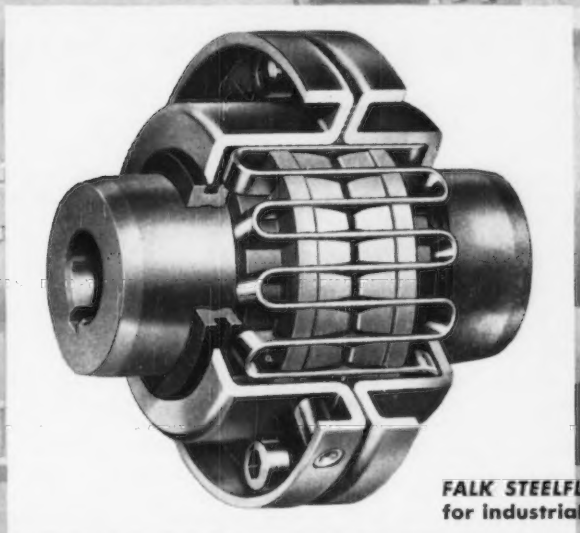

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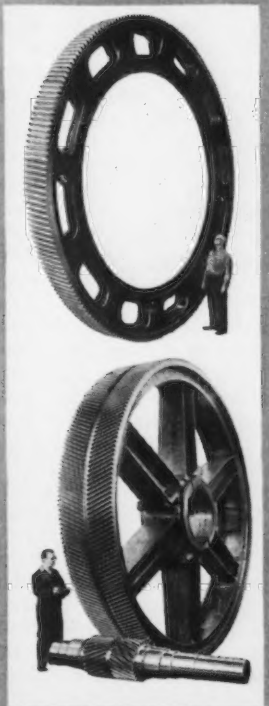

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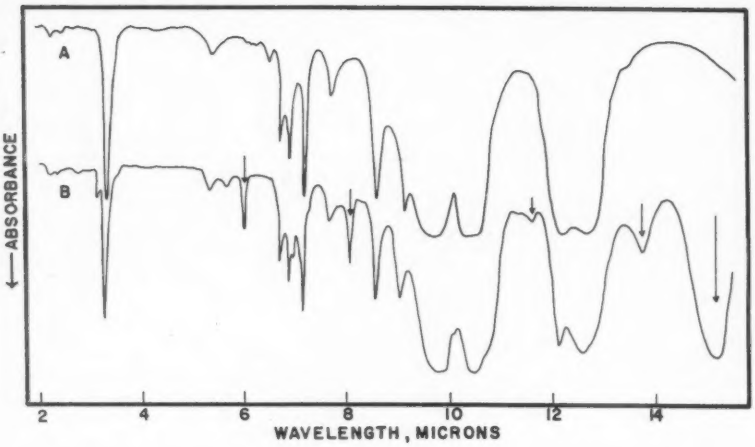
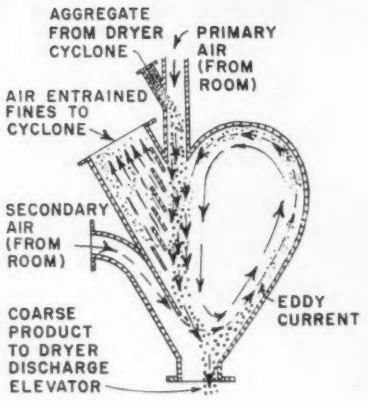


INFRARED ANALYSIS, a simple fast technique, has come within range of more users as moderate-priced instruments have come on market. Curves here represent results of tests comparing two flotation reagents.


AGGREGATE FROM DRYER CYCLONE
PRIMARY AIR (FROM ROOM)
AIR ENTRAINED FINES TO CYCLONE
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to operate and fast, this technique cuts way down on the time needed for many analyses.

Aluminum processing has been in the news in 1960. Aluminium, Ltd., of Canada (Alcan), announced plans to build a $4-million, 8,000-tpy pilot plant at Arvida, Que., to test a new direct reduction process that would obviate the Bayer process for making alumina from bauxite. In commercial aluminum-making refining comes before smelting, in contrast to processes for making copper, steel, and other metals, where refining comes last. The Bayer caustic-leaching process refines bauxite ores, which contain Al_2O_3 and other contaminant oxides, to give pure alumina. Then the Hall electrolytic process smelts the alumina to yield molten aluminum metal.

Though details have not been made public, Alcan's process reportedly would do the smelting first—electrolytically, as before. Then the metal would be refined by vapor distillation in a converter-condenser system. A molten-salt bath, containing cooling-water coils and floating on top of molten aluminum in the condenser, would remove excess heat from the aluminum bath.

In the same vein, two French aluminum producers, Pechiney and Ugine, have built a pilot plant to test another direct-reduction scheme. No details have been published, but since the plant was scheduled to open by New Year's Day, details should be forthcoming. Object of both new schemes would be to avoid the capital cost of the Bayer process.

Australia's Division of Mineral Chemistry has been working on a new acid process to produce alumina from clays and aluminous laterites.

A new, simple process for treating schroeckingerite uranium ore was announced by Hack Engineering Co. of Denver. It involves a new, undisclosed reagent, which costs less than 20c per ton of ore processed and requires no stainless steel or rubber-lined equipment. Hack will build a 150-tpd plant for Lucky June Mining Co. near Rawlins, Wyo.

Tonnage oxygen in nonferrous smelting has been tested by two large copper producers, Kennecott and Anaconda. Kennecott plans to spend $750,000 for a pilot plant to test use of oxygen in reverberatory furnaces at its Garfield, Utah, smelter. A prominent metallurgical engineer in the copper industry stated early in the year that such developments as oxygen smelting, which has been developed in the steel industry, point the way in which copper metallurgists must explore to cut their production costs.

A new continuous process for producing columbium metal was developed by Battelle Memorial Institute. This could be of great importance because many people feel that demand for columbium will grow on the order of tenfold in the coming decade (E&MJ, October 1960, p 95). Though the process has been developed only on a laboratory scale, it might form the basis for a production-scale process. Hydrogen reduces volatile columbium pentachloride in a fluidized bed of seed columbium particles, and the reduced columbium deposits on the seed particles. Grinding some of the finished product replenishes the seed.

In an unusual flowsheet, which uses shaking tables, magnetic separators, and flotation of pyrite, calcite and pyrochlore, the columbium mineral pyrochlore will be concentrated at a new plant of St. Lawrence Columbium & Metals Corp. in Quebec's Oka district (E&MJ October 1960).

A novel method of trucking molten aluminum for 100 miles over public highways reportedly is being used by Aluminum Co. of America. Alcoa's new Warrick, Ind., smelter is partially complete; one potline out of five planned went onstream in June. Customer for the molten aluminum product is a General Motors Corp. plant in Indiana. The molten metal is hauled over the road in insulated trucks.

A new type of air classifier, the "Gravitational-Inertial" classifier made by Buell Engineering Co., has entered the flowsheets of some phosphate rock and limestone processers (E&MJ, October 1960). The classifier makes it possible to recover valuable fines that were formerly lost, as well as helping to solve a dust problem, at American Agricultural Chemical Co., Pierce, Fla. Large particles, with high inertia, cannot make an abrupt turn, which small ones are forced to make along with the air in which they are entrained. Thus the classifier separates coarse from fine particles. A secondary air flow scrubs tramp fines from coarse particles as they leave the device.

An old, long-established practice in the fire refining of copper, poling, has been eliminated at the Douglas, Ariz., smelter of Phelps Dodge. Re-formed natural gas now does the job that green timber logs used to do, that of reducing copper oxides after removal of impurities. Phelps Dodge de-

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veloped and patented the new technique in a broad research program (*E&MJ*, September 1960).

Reducing gases are formed by air-re-forming of natural gas in a plant adjacent to the smelter anode department, and are piped to the anode furnaces. Similar re-forming plants have been designed for the Ajo and Morenci smelters. By eliminating poling, P-D has improved safety and good housekeeping, cut out the need for pole storage space, and lessened workload on converter aisle cranes.

Autogenous grinding, where ore grinds itself without use of steel balls or rods, will take a big step forward when the huge 60,000-tpd Quebec Cartier iron ore concentrator at Lac Jeannine, Que., starts up next year. Twelve Hardinge autogenous mills, 18 ft in dia. and only 5 ft long, will handle the whole mill flow. All concentration will be done by Humphreys spirals, over 2,300 in all, and the counterflow sizer, described in *E&MJ*, July 1960, will treat rougher spiral concentrates ahead of cleaner spirals. Fluosolids driers reportedly will dry the spiral concentrates.

Ores Being Preblended

Preblending of ores, to give the mill a uniform and controlled feed flow, is a reality at some modern processing plants. At the brand-new Viburnum mill of St. Joseph Lead Co. (see pp 65-78) the mill operator will be able eventually, by pushbutton control, to blend ores from three separate mines. When all three mines are in production, these ores will be crushed, assayed, and stored in separate silos at the mill.

Kaiser Steel Corp.'s Eagle Mountain (Calif.) beneficiation plant will soon have a new ore blending system; it is being built now. It will be like the ore storage system at Kaiser's Fontana steel works. Ore is stacked in long piles by moving stacker-conveyors, which travel lengthwise of the piles. It is later reclaimed by a reclaimer digging-wheel which cuts a cross-section of the pile. The reclaimer discharges to a belt system feeding the mill. First there is an averaging effect, as the stacker distributes material along the length of the pile; later there is a further averaging effect, as the reclaimer cuts the pile cross-wise. As a result, the mill gets a smooth feed, free of grade variations of ores from different parts of the mine.

Some figures on Kaiser's new system: total storage capacity, one million tons in four beds; traveling stackers, 77 ft high with two 95-ft booms, rate of travel 30 fpm; reclaimer, two 34-ft-dia digging wheels cutting ore bed perpendicularly.

Iron ore beneficiation continues in the news. The new Humboldt plant of Cleveland-Cliffs Iron Co. and Ford Motor Co., which opened last year (*E&MJ* October 1960), represents the first commercial installation of Allis-Chalmers' grate-kiln pelletizing process. The Humboldt plant, where flotation and grate-kiln upgrade and pelletize the specular hematite jasper ores of Michigan's Upper Peninsula, will turn out 650,000 tpy of 62%-Fe pellets.

Michigan's jaspers thus are the second type of low-grade iron deposit in the Lake Superior region to become economic ore. Minnesota's magnetic taconites have been mined and processed for four years by Reserve Mining Co. and Erie Mining Co. Reserve's announcement late last year, that it would expand its annual capacity from 5½- to 9 million tons at a cost of $120-million plus, proved that its taconite operations have been economically successful.

Next Target: Semitaconites

Now a third type of low-grade deposit will come under attack; this is the nonmagnetic low-grade material on the Mesabi Range known as semitaconite. Oliver Iron Mining Div. (U.S. Steel Corp.) and M. A. Hanna Co. both announced last year their plans to build pilot plants to test magnetizing reduction roasting, using Lurgi kilns (*E&MJ* July 1960). In the process, hematite will be partially reduced to magnetite, which will then be concentrated magnetically. Miners will be watching these two plants. If they lead to an economically successful process, they will open the door to a virtually unlimited supply of domestic iron ore, since reserves of semitaconites are estimated to be billions of tons.

More and more plants on the Mesabi have installed scrubbers ahead of their dense-media concentration sections (*E&MJ* September 1960).

Further down the line from ore to iron metal, direct reduction processes continue to be developed. Two new processes were announced in 1960, Dwight-Lloyd McWane and Allis-Chalmers Agglomeration-Reduction (E&MJ December 1960). Hojalata y Lamina S.A., Monterrey, Mexico, started up its new, latest-design 500-tpd HyL sponge-iron plant; Bethlehem Steel was at year's end starting its new H-Iron plant at Los Angeles; Webb & Knapp Inc. and Bonneville Power Administration signed a power contract for the Strategic-Udy plant that W&K will erect at Anaconda, Mont., to make steel and byproducts from copper-smelter slag.

A primary iron and steel industry for Western Canada and the first North American commercial pig-iron electric furnace smelting raw ore are on their way to becoming realities. Major construction for the Consolidated Mining and Smelting Co.'s new electric-furnace plant at Kimberley, B.C., was scheduled to be completed last fall. Raw materials for Cominco's iron process will be iron oxide calcines from roasting of iron sulphide concentrates. Sulphur dioxide from this roasting has been used since 1953 to make sulphuric acid for the company's fertilizer plant at Kimberley. The new plant will bring about full utilization of the complex sulphide ores from the Sullivan mine.

Copper Silicates Treated

Silicate copper minerals, long considered untreatable, are being attacked by the "segregation" process in Transarizona Resources' plant, south of Casa Grande, Ariz. (*E&MJ* November 1960), which began operating last year. Segregation is an old but little-used process (*E&MJ*, Nov. 16, 1929, reported its original development by Minerals Separation of London), but interest in it has recently picked up; USBM's research on it was described in Report of Investigations 5501, 1959. Ore is heat-treated with carbon (coke) and common salt; particles of metallic copper deposit on the carbon, and are then recovered by flotation. If the new plant succeeds economically, many mixed oxidized copper deposits, particularly those associated with limestone, where leaching is too expensive, may become minable.

London was the scene in April of the fifth International Mineral Processing Congress. The Institution of Mining and Metallurgy, which played host, recently published a 1,118-page volume containing the 52 papers presented, together with discussions by the delegates and authors' replies. The volume is available from the Institution, 44 Portland Place, London, W. 1, England, at a cost of $14.50.

"Breaking the temperature barrier" might be an apt way to describe plasma phenomena, reported in *E&MJ* October 1960 by Paul M. Tyler, consulting metallurgical engineer to the Materials Advisory Board in Washington. Controlled temperatures approaching 50,000°C, and tremendous concentrations of energy in a small space, are now available. Some day these may open new doors to the pyrometallurgist of the future.

NOW!

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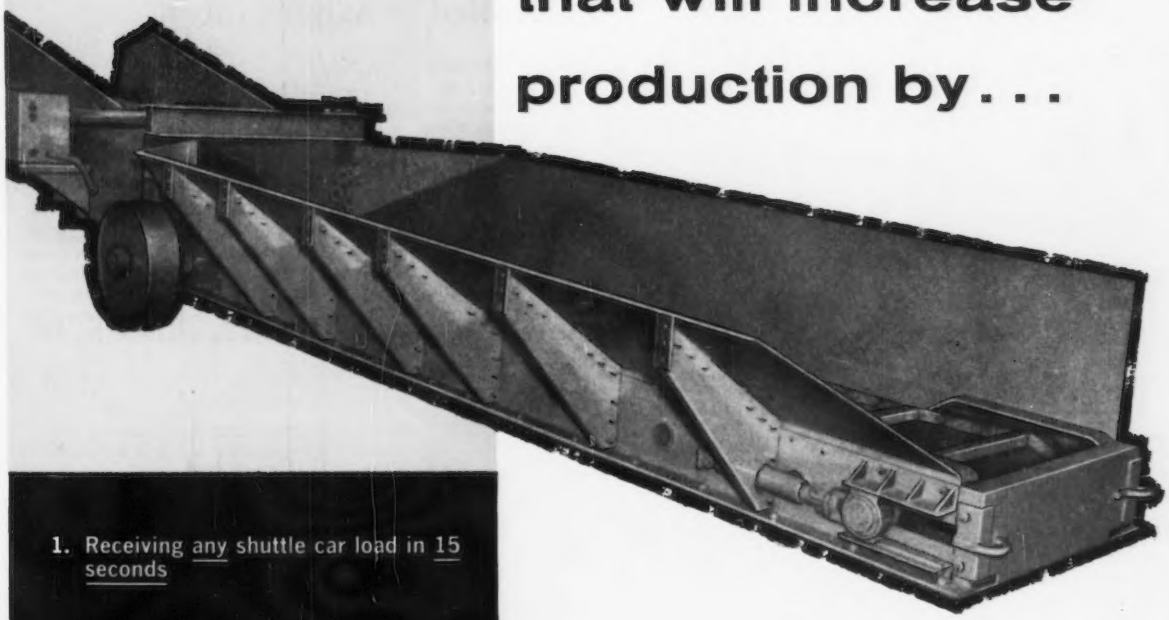

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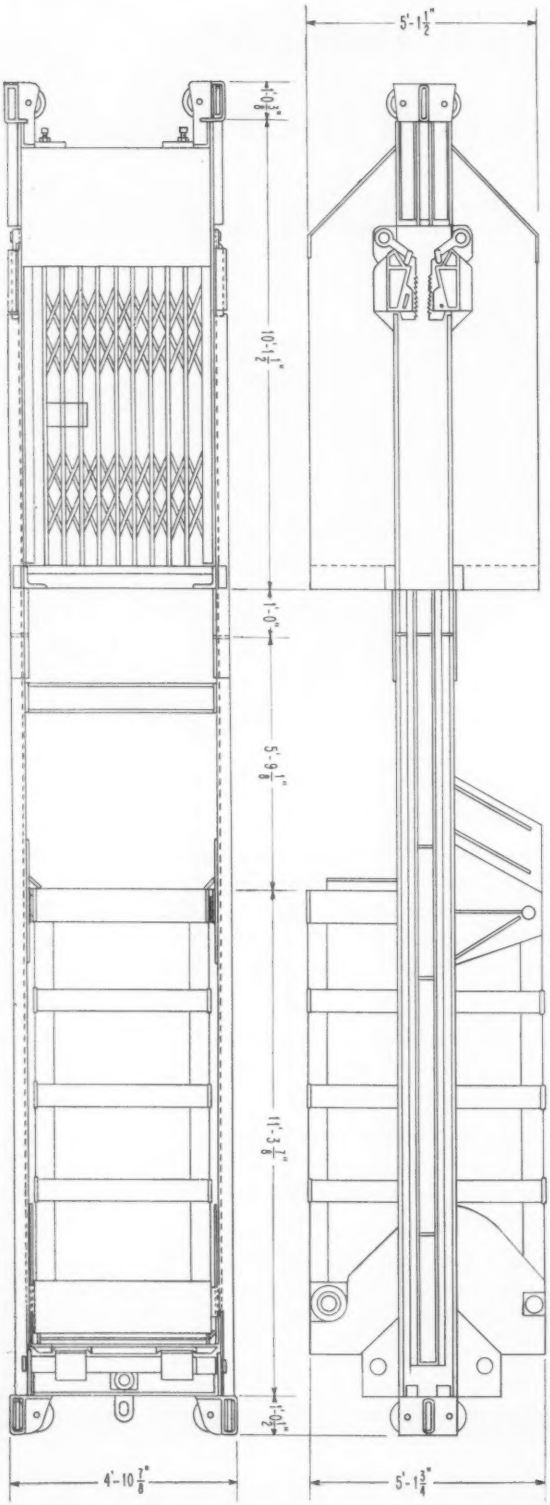
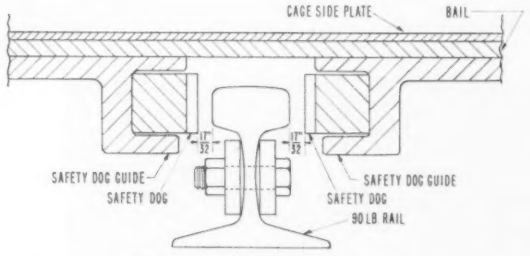


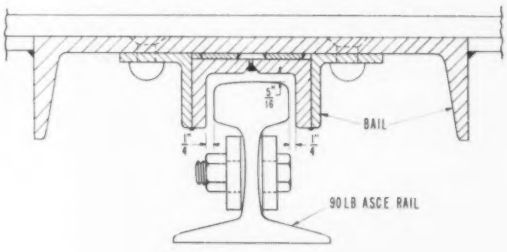
THREE-TIRE ASSEMBLIES mounted at top and bottom of the bail assure smooth travel of skip and cage in the shaft.

Skip and Cage Equipment Installed at Viburnum

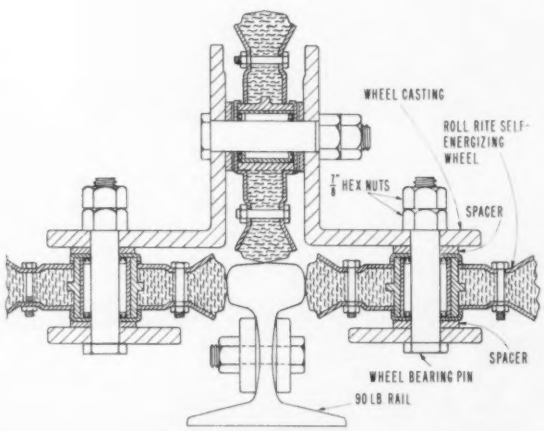
SKIPS AND CAGES at the No. 27 and 28 Viburnum units of the St. Joseph Lead Co. in southeastern Missouri are constructed as shown in the accompanying drawings. Capacity of the bottom-dump skip is eight tons. The cage mounted above the skip holds nine men. Safety dogs, designed to engage the 90-lb rail guides in the shaft, are mounted near the top of the cage. Two sets of three rubber-tired wheels are mounted at the top and bottom of the rigid assembly. Details of bail construction, safety dogs and the triple rubber-tire assemblies which travel along the steel guides are shown below. Rope speed in the shaft is 900 fpm. Rope diameter is 1⅝ in. The combination of this equipment, plus steel rail guides in the 12½-ft concrete-lined circular shaft, makes it practically maintenance free, except for spill mucking provisions at the bottom of the shaft described on p 67.



RELATIONSHIP OF SAFETY DOGS TO RAIL



RELATIONSHIP OF BAIL TO RAIL



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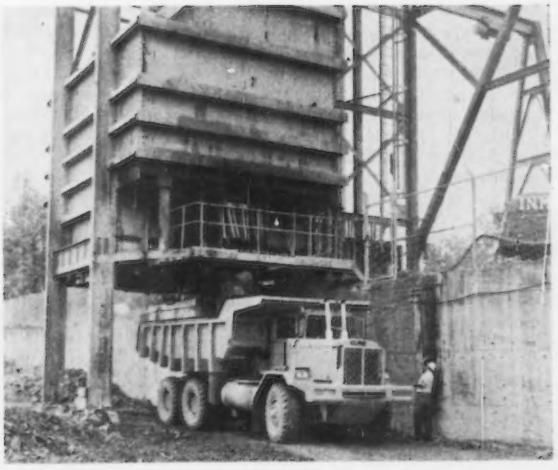
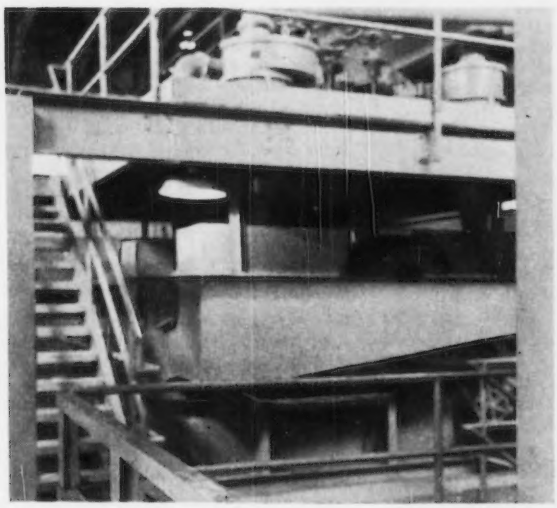


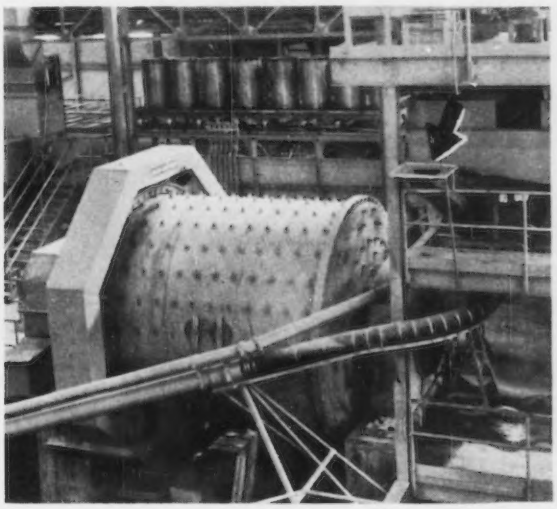
Radio Control Operates Ore-Bin Gate at Viburnum

THIRTY-TON TRUCKS, which haul ore from the No. 27 shaft of St. Joe's Viburnum project in Missouri, are equipped with a large side mirror and a radio control box, enabling the truck operator to load his truck without getting out of the cab. L. H. Casteel, assistant division manager of the Southeast Missouri Mining and Milling Division, points out these two devices. Note the mirror beside the door and the small box in the upper right corner of the cab. After the driver has spotted his truck properly beneath the ore bin, as shown at right, he opens the bin gate by remote radio control. The large mirror shows him how loading is progressing. When the truck is properly loaded, the driver shuts the gate by remote radio control and is on his way. Driver, at right, demonstrates alternative manual control system.



Cyclone-Underflow Weigher

ONE OF THE REQUISITES for automatic control of the ball-mill grinding circuit at the Viburnum mill is the determination of the circulating load on the system. The ball mill is in closed circuit with four cyclone classifiers. The weighing box, shown above, is hinged at the left end and suspended by levers connected to a weighing device at the right end (not shown). Thus, a constant volume of cyclone underflow can be weighed continuously to determine the circulating load. Photo, at right, shows an opposite view of box and the ball mill. A flowsheet of the grinding circuit and diagram of automatic controls in the circuit appear on p 72.



Trap-Door Ball Loader

BALL CHARGES are introduced into the ball mill at the Viburnum mill with an automatic unloading hopper. This small steel portable hopper containing the proper weight of grinding balls is fitted with a small trap door on the under side which is attached to the crane cable. The operator hoists the hopper with ball charge to the small platform, shown above. When tension is released on the overhead crane cable, the trap door opens and permits the grinding balls to roll down the steel chute that connects the platform with the feed intake of the ball mill. Plan of the mill on p 73 shows the location of the ball mill and the ball receiving and storage area.

PERSONALS

Dr. William A. Mudge, one of the nation's pioneer metallurgists, retired from the International Nickel Co. in 1958 as assistant to the president. Now, at the age of 68, he has become a lecturer in metallurgical engineering at NYU.

In 1924, Dr. Mudge discovered the age hardening of nickel, and in 1926 he developed the first commercial process for manufacturing clad steels.

James N. Landis, vice president of the Bechtel Corp. of San Francisco, was elected president of the Engineers Joint Council. George E. Holbrook was reelected vice president.

The Arthur L. Day gold medal of the Geological Society of America has been awarded to Stanford University's associate dean of the school of mineral sciences, **Konrad B. Krauskopf.** Dr. Krauskopf, professor of geochemistry, was cited for his "brilliant research" into the characteristics of ore-bearing fluids.

Sir Percy Hunting

G. L. Hunting

Sir Percy Hunting, chairman of the Hunting Group of shipping, oil, aviation, survey and engineering companies, retired at the end of the year. He has been succeeded by his brother, **G. L. Hunting,** formerly vice chairman. Sir Percy's son, **Pat Hunting,** has become vice chairman.

Sir Percy, who is retaining some of his directorships, represents the third generation in the Hunting family business, which was founded in 1874. Apart from the Hunting fleet of oil tankers and bulk carriers, the Group has the largest network of aerial survey and mapping companies in the world, extending throughout the British Commonwealth and North and South America, companies concerned with the investigation of the world's natural resources.

Edward McL. Tittmann was named president by the board of directors of Southern Peru Copper Corp. He retains the chairmanship of the executive committee.

Other appointments were: **F. W. Archibald,** vice president and general manager in charge of all operations in Peru; **D. J. Buckwalter,** smelter superintendent.

W. T. Irvine and **R. G. McEachern** have been appointed to new senior geological positions with the Consolidated Mining and Smelting Co. Irvine, with Cominco since 1947, will be chief mines geologist. McEachern, who joined the company at the Sullivan Mine in 1942, becomes chief exploration geologist.

Jack Morgan has been appointed technical service manager of Foundry Services, Inc. Formerly chief metallurgist for Foundry Services (Canada) Ltd., he had also been affiliated with High Duty Alloys, Ltd., Stough, England.

Morgan is the author of several technical papers. He is also co-holder of patents pertaining to heat treatment of aluminum and magnesium alloys.

Morgan

Daman, Jr.

Arthur C. Daman, Jr., has returned to Denver from Lima, Peru, where he organized and managed Denver Equipment Co., S.A., for the past three years. In his new assignment, he will be attached to the International Sales Division. He will be responsible for all sales activities in Latin America, including Mexico, Central America and South America.

Ernest W. Neben has been appointed to an executive management position at WEMCO, a division of Western Machinery Co. A member of the American Society of Mechanical Engineers, National Society of Professional Engineers and American Institute of Chemical Engineers, Neben has a background of 20 years of engineering.

Neben

Buerger, Jr.

Josef H. Buerger, Jr., has been appointed assistant to the vice president at the Crucible Steel Co. of America. He will assist in all administrative functions of the commercial department and have full responsibility for assigned new commercial studies. He was formerly vice president of marketing with Yuba Consolidated Industries in San Francisco.

Earle M. Jorgensen, president and chairman of Earle M. Jorgensen Co. of Los Angeles, has been elected to the board of directors of American Potash & Chemical Corp.

Ward E. Ballmer has been named public relations director for the Uranium Producers of New Mexico. He was formerly director of public relations for the Utah Copper Div., Kennecott Copper Corp.

A. J. Teske, secretary of the Idaho Mining Association, was named chairman of the western governors' mining advisory council. **Russell W. Beamer,** executive secretary of the Wyoming Mining association, was named vice chairman of the group, and **Frank P. Knight,** director of the Arizona department of natural resources, was reelected secretary.

Marcus David Banghart, vice president of Newmont Mining Corp., has been awarded the William Lawrence Saunders Gold Medal for 1961 by the American Institute of Mining, Metallurgical, and Petroleum Engineers.

OBITUARIES

Edward P. Scallon, 77, well-known in Minnesota mining circles, died in St. Paul recently. He was a past chairman of the Minnesota section of the American Institute of Mining and Metallurgical Engineers.

Scallon began his mining career on the Mesabi range in 1912. From 1918 to 1930 he was superintendent of mines on the Cuyuna range for the Clement K. Quinn Ore Co.

He served in the Minnesota state legislature from 1923 to 1933. In 1937 he moved to St. Paul as assistant to the president of Butler Bros., until their operations were taken over by the M. A. Hanna Co. in 1949.

Hayden F. Sears, 48, superintendent of taconite mines for Pickands Mather & Co., died at Hoyt Lakes recently. He began as a mining engineer in the Hibbing district with PM&Co. in 1936, became superintendent of the Corsica mine at Elcor in 1948, and later, superintendent of taconite mining for Erie Mining Co.

Frank A. Wildes, 89, superintendent of Minnesota State Mines and Mineral lands, died recently in St. Paul.

George A. Goodwin, president of the American Society of Tool and Manufacturing Engineers in 1958-59 and a director for more than 10 years, died recently. Funeral services were held in Dayton, Ohio, where Goodwin was works manager of Master Electric Co.

Ray M. Henricksen, director of the Nevada Mine Operators Association in 1956 and 1957, died recently in Los Angeles. He had been an associate professor of mining and ore dressing at the University of Alaska from 1930 to 1938. Later, he worked in mining operations and as a mining consultant in western states.

Harold E. Taylor, superintendent of the coke and chemicals department of Alan Wood Steel Co., died recently at 60 years of age. He joined Alan Wood, Conshohocken, Pa., in 1929 as general oven foreman, became assistant superintendent in 1945 and superintendent in 1956.

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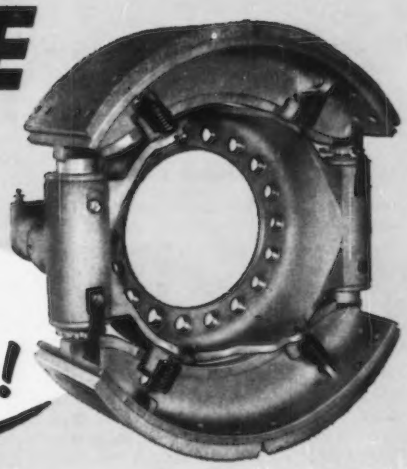

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WHAT'S NEW IN PATENTS

OLIVER S. NORTH

U.S. PATENTS

Mining

A drilling mud for use in drilling through trona beds consists of fuller's earth and an aqueous brine consisting of sodium chloride, sodium carbonate, and sodium bicarbonate. This mud will not dissolve the trona. W. R. Frint, assigned to Food Machinery & Chemical Corp. U.S. 2,957,822.

Design for an improved mine hoisting installation for lowering and raising of stages during shaft sinking. R. Blair. U.S. 2,961,216.

Metal and Mineral Processing

Improved apparatus for introducing and uniformly distributing gases during the continuous chlorination of rutile or other titaniferous materials. W. M. Coates and J. Hayden, assigned to British Titan Products Co. Ltd. U.S. 2,957,757.

In a low-cost method for agglomerating iron ore fines, the fines are mixed with hot gases, and the mixture moistened with an atomized spray of relatively cool water. The fines are deposited on a surface as a solid crust, which is continuously broken away as finished agglomerate. W. T. Purvance, assigned to U.S. Steel Corp. U.S. 2,958,596.

In the recovery of columbium values from ores such as pyrochlore, perovskite, niocalite, and betafite, the ore is ground to flotation size, pulped, conditioned with a frother, an amine promoter and a fluoride or fluosilicate selective activator, and subjected to froth flotation to float columbium values. A mica depressant can be added if needed. J. A. R. Faucher, assigned to Technical Managers Inc. U.S. 2,959,281.

In the pelletization of specular hematite or like iron oxide ores, the relatively coarse specular ore concentrate is mixed with solid fuel, bentonite, and 15-75% of more relatively finely divided magnetite or magnetic taconite. The mixture is balled, and the balls subjected to heat to effect oxidation and grain growth of the magnetite particles among the specularite particles. F. D. De Vaney, assigned to P-M Associates. U.S. 2,960,396.

In the separation of cobalt and nickel in mixed salt solutions, a solid metalloid more electronegative than nickel—e.g. arsenic or sulphur—is added to the solution, and the pH maintained between 1 and 5. The nickel separates as a solid material, and the cobalt remains in solution. F. Reynaud and A. Roth, assigned to Soc. d'Electro-Chimie d'Electro-Metallurgie et des Acieries Electriques d'Ugine. U.S. 2,960,400.

Mr. North is patent consultant, Washington, D.C.

In the separation of feldspar froth-flotation concentrates into potash-rich and soda-rich fractions, the concentrate is treated with silica gel, colloidal silica, sodium silicate, or the like, heated, caused to accept an electrical charge, and electrostatically separated into the desired products. R. E. Snow, assigned to International Minerals & Chemical Corp. U.S. 2, 961,092.

CANADIAN PATENTS

Metal and Mineral Processing

In the recovery of tungsten from scheelite, the ore concentrate is mixed with sodium carbonate, and the mixture roasted in the presence of carbon dioxide to form sodium tungstate and calcium carbonate, whereby decomposition of the calcium carbonate is prevented and maximum recovery of tungsten values obtained. R. L. Pilloton, assigned to Union Carbide Corp. Oct. 25, 1960. Canadian 607,641.

In the beneficiation of sylvinite, the ore is ground to flotation size, pulped, treated with an aliphatic amine collector and methyl silicone or other water-insoluble silicone modifier, and subjected to froth flotation to produce a high-grade granular sylvite product. E. A. Schoeld and J. M. Fritschy, assigned to Potash Co. of America. Nov. 1, 1960. Canadian 608,026.

Design for an improved reactor for the fluidized bed roasting of pyrites or other metallic sulphides, magnetite concentrates, and the like. Structural stresses normally encountered in large fluid-bed reactor installations are substantially lessened by placing extended surfaces in a generally vertical position throughout the fluidized bed. P. C. Keith, assigned to Hydrocarbon Research, Inc., Nov. 8, 1960. Canadian 608,383.

Method for producing high-purity nickel anodes is suitable for the electrolytic recovery of nickel, along with elemental sulphur, from nickel matte. The matte is melted and the melt slowly cooled under controlled conditions to produce a non-brittle, non-cracking matte anode. L. S. Renzoni and W. V. Barker, assigned to International Nickel Co. of Canada, Ltd. Sept. 27, 1960. Canadian 605,955.

A method for preventing the settling of pulped uranium ore during leaching uses an aqueous solution of polyvinyl alcohol in a concentration of at least 0.01 pound per ton of uranium ore contained in the pulp. This reagent is a more stable and effective suspending agent than the animal glue previously used for this purpose. F. W. Matthews and M. Morf, assigned to Canadian Industries Ltd. Sept. 27, 1960. Canadian 606,012.

In a design for a grating for use in fluidized-bed ore roasting furnances, uniform distribution of the fluidizing gas is attained. The grating is constructed of parallel rods in contact with each other and provided with gouged or milled grooves at suitable intervals. K. H. Hoffman, assigned to "Berzelius" Metallhutten-G.m.b.H. Oct. 4, 1960. Canadian 606,162.

Apparatus for and method of making pellets, e.g. iron ore pellets, of predetermined size and moisture content from powdered magnetite or other iron ore concentrates or fines. High-moisture-content pellet nuclei are formed, and these nuclei are then rolled in ore fines of lower moisture content to form larger pellets. P. E. Cavanagh, assigned to Ontario Research Foundation. Oct. 4, 1960. Canadian 606,324.

In the concentration of phosphate values from phosphate ores or sylvite from sylvinite ore, ground ore is suspended in a vertical gas stream and subjected to lateral attractive and repulsive forces of an electrostatic field. I. M. Le Baron, assigned to International Minerals & Chemical Corp. Oct. 11, 1960. Canadian 606,683.

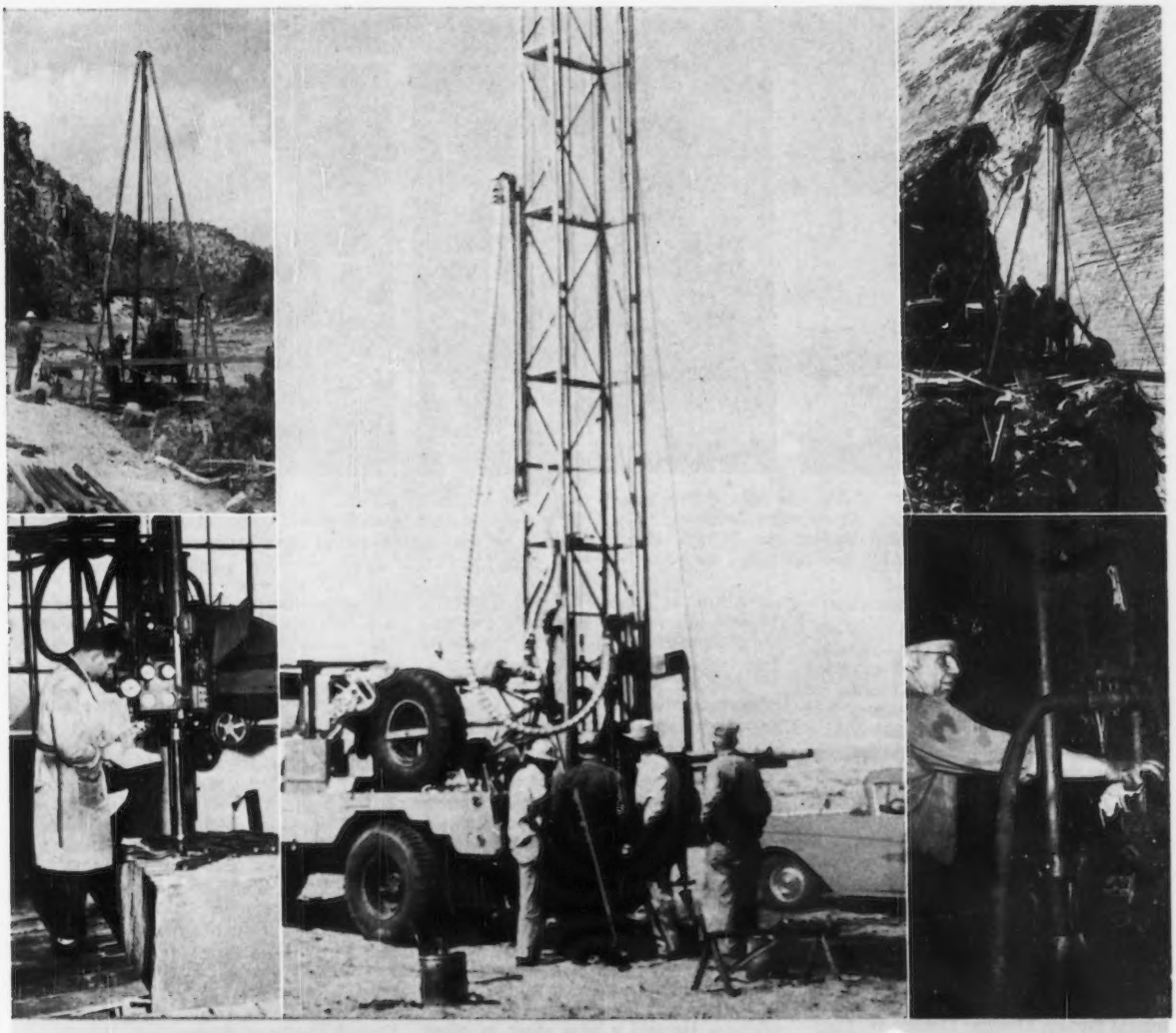
Multi-stage pyrometallurgical method for producing ferromanganese, ferromanganese silicon, etc., from relatively low-grade manganese ores, concentrates, or other source materials. M. J. Udy, assigned to Strategic-Udy Metallurgical & Chemical Processes, Ltd. Oct. 11, 1960. Canadian 606,717.

In a method for continuously controlling particle size during the grinding of ores, the speed of rotation of the mill is regulated so that a finer product is produced at lower speeds and a coarser product at higher speeds. A. B. Noren, P. A. H. H. Fahlstrom and J. C. Burstrom, assigned to Bolidens Gruvaktiebolag. Oct. 11, 1960. Canadian 606,768.

In the reduction of lean iron ores, particularly ilmenite, the ore particles are homogenized by heating them to a temperature of 900-1300° C. in a carbon dioxide-carbon monoxide or hydrogen-steam atmosphere, cooled, and the coarse-grained iron and iron oxide particles separated magnetically, by flotation, or by melting. G. Ostberg, assigned to Stora Kopparbergs Bergslags Aktiebolag. Oct. 18, 1960. Canadian 607,142.

Copies of U.S. Patents can be purchased at 25c each from the Commissioner of Patents, Washington 25, D.C.

Copies of Canadian patents can be obtained by writing to Commissioner of Patents, Patent & Copyright Office, No. 8 Bldg., Carling Ave., Ottawa.



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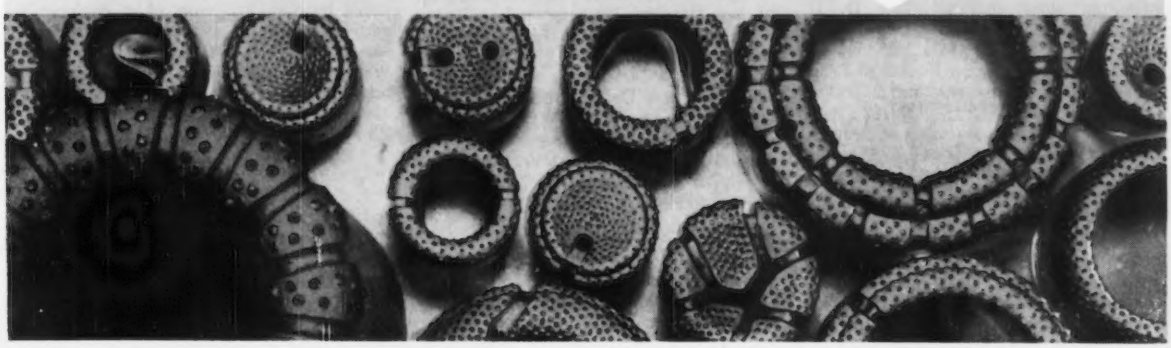

FRANC R. JOUBIN, president of Bralorne Mines, gives some deep thought to a question (left). At the main luncheon, "Miss Spokane" made her traditional appearance. (That's Elmer Jones, of Viburnum and St. Joe, at her left.) The oldest registrant at the 66th annual meeting was James F. Markwell, founder of Hercules Mining Co., with John Currie.

NWMA Meeting (*Continued*)

6800 square miles. Three of the quadrangles have been mapped and surveying work has been started in the fourth. He said that so far the mineral survey had not indicated potential for any major mining development in the area, but there are indications of moderate mineralization that warrant more intensive prospecting.

"Additional prospecting, coupled with development, may uncover some noteworthy deposits—mainly manganese and copper, and nonmetallic minerals such as barite and talc," Johns said. His talk was at a geology session Dec. 2, which included discussions by A. J. Eardley, Dean of the College of Mines, University of Utah; Arnold L. Brokaw, U.S. Geological Survey, Denver; Donald W. Lindgren, of Lindgren & Lehman, St. Paul, Minn.; and Frank A. Crowley, Montana Bureau of Mines and Geology.

A session on metallurgy included presentations by: Glen C. Ware, chemist, U.S. Bureau of Mines, Albany, Ore., "Electro-Deposition of Zinc on Zinc Starting Sheets"; W. C. Aitkenhead, director of the mining experiment station of the Division of Industrial Research, Washington State University, Pullman, "Injurious Impurities in Zinc Sulfate Electrolytes and Their Removal"; H. D. Moulton, sales engineer, and D. R. Asher, research chemist, Dow Chemical Co., Grand Junction, Colo., "Evaluation of a Strong Base Anion Exchange Resin for Uranium Recovery from Alkaline Carbonate Solution"; Joseph F. Town, metallurgist, U.S. Bureau of Mines, Albany, Ore., "Flotation of Mercury Ores"; and Larry M. Grossman, chemist, United Paint Manufacturing Co., Spokane, "Preparation and Protection of Metal Surfaces."

Continued growth of the Western phosphate industry was predicted by William G. Hewitt, general manager of the Pacific division of Bunker Hill Co. In a talk at a general session Dec. 3, he said this would mean more emphasis on phosphate rock mining and beneficiation and added demand for sulfuric acid. He said the West has large resources of phosphate rock, which will support a major phosphate industry for generations.

Ottey M. Bishop, chief of the division of mineral resources of the U.S. Bureau of Mines office at Albany, Ore., declared that known reserves of many minerals are near the vanishing point and added that new sources for many minerals must be found to sustain an increased population. Bishop cited the United States' growing dependency on foreign sources for such minerals as tin, chromite, platinum, cobalt, graphite, industrial diamonds, nickel and long-fiber asbestos. He said a large share of other minerals such as cadmium, copper, iron ore, mercury, tungsten, bauxite and fluorspar also are imported.

Other speakers at the Dec. 3 general session included Edward D. Tierney, assistant vice president, Anaconda Co., Butte, Mont., "Recent Metallurgical Changes at Anaconda"; Wesley T. Holmes, metallurgist, U.S. Bureau of Mines, Albany, Ore., "Beneficiating and Smelting of the Carter Creek Iron Ore"; and Ralph A. Watson, geologist, Great Northern Railway company, Seattle, "Topographical and Geological Mapping of the State of Washington."

Stewart W. Hurlbut, senior research engineer, Anaconda Co., Butte, discussed "Work Sampling as a Productivity Indicator" at a Dec. 3 session on industrial engineering. Citing experiences of the firm in its Butte area operations, Hurlbut said work sampling can give managers and supervisors an accurate picture of how manpower is being utilized.

Other speakers at the session were: T. G. Howe, supervisor, methods study, Consolidated Mining and Smelting Co. of Canada Ltd., Kimberly, B.C., "Work Measurement at the Sullivan Mine"; Theodore Barry, management consultant, Los Angeles, "Industrial Engineering—Mining's New Profit Bonanza"; and D. E. Redmon, mining methods research engineer, U.S. Bureau of Mines, Denver, "Industrial Engineering in Mining."

The tremendous growth of the Canadian mining industry since World War II was outlined by Marc Boyer, Canada's deputy minister of mines. He said the total value of output of the Canadian mineral industry will be a record $2.5-billion. Citing a growing economic interdependence between Canada and the U.S., he said restrictive measures on the part of the U.S. in importing minerals and mineral commodities would have a direct and immediate effect on the mineral industry of Canada. He spoke at a Dec. 3 luncheon session.

Boyer said Canada's mineral industry exports have been largely at the primary and semi-processed levels, adding that it is to any country's advantage to do a maximum amount of economic processing within its own borders. He said he expected continued expansion of Canada's mineral industry, but added that it would be dependent upon expansion of the Free World's industrial economy.

"Long Hole Drilling at the Pend Oreille Mine" was one of the highlights of a mining session Dec.3. A paper prepared by Roy Anderson, chief engineer, and Herb Malone, engineer, Pend Oreille Mines and Metals Co., Metaline Falls, Wash., was presented. They said use of both diamond drilling and pneumatic long-hole drilling will continue at the big lead-zinc property.

Anderson said advantages of long-hole drilling include:

1. Faster drilling, 160 ft per shift compared with 30 ft.
2. Easier and quicker to make set-ups.
3. More mobile; can be moved about the mine under its own power.
4. Requires one operator instead of

(*Continued on p 112*)

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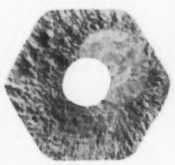

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NWMA *(Continued)*

two for the diamond drill.

5. Cost per foot, including labor and supplies, at the Pend Oreille this year (1960) is $0.39 per ft as compared with $2.74 per ft for the underground diamond drill.

Disadvantages cited by Anderson include:

1. Does not give the detail in the cuttings that is given in diamond drill core.
2. Holes tend to wander more than diamond drill holes do.
3. A tendency for the samples to be salted.
4. There is more likelihood of sticking the drill rods than in a diamond drill hole.

Anderson said long-holing has been in effect at the Pend Oreille for about a year. The unit now in use at the mine has drilled as much as 280 ft per shift and averages more than 160 ft. It is a Gardner-Denver PR 123 mounted on a SHF-4 aluminum shell with automatic screw feed, mounted on a D-4 Cat.

New developments in mine shaft-sinking methods were described by Edward R. Borcherdt, San Francisco mining consultant. He also described new low-headroom loaders. Other speakers at the mining session were Troy M. Tower, unit superintendent, and L. S. Hansen, safety engineer, American Smelting and Refining Co., Kellogg, Idaho, "Some Aspects of Hoisting Practices at the Page Mine"; and Dave E. Aro, general superintendent, J. R. Simplot Co., Conda, Idaho, "Conda Phosphate Operation of the J. R. Simplot Co."

The Anaconda Co.'s five-year program to improve and deepen its underground operations at Butte, Mont., was described by Martin K. Hannifan, the firm's manager of mines. He said it will provide the company with a centralized hauling and hoisting system for five mines and it will give additional ore hoisting capacity for deep vein mining. He spoke at a "New Developments" session Dec. 3. Hannifan said the program would help assure Butte's future as a major mining district. Other speakers included Norman A. Moberg, director of mineral development, Oliver Iron Mining Div., U.S. Steel Corp., Duluth, "Taconite Developments in the Lake Superior Region"; E. P. Leach, general manager, raw materials division, Bethlehem Steel Co., Bethlehem, Pa., "Iron Ore Mining in South America"; and John A. Laberee, Pacific district manager, extension division, E. I. DuPont de Nemours & Co., Inc., Palo Alto, Calif., "The Menace of the Misinformed."

Proposed legislation to enlarge prediscovery rights of mineral locators was discussed at a "Land Laws" session Dec. 3 by G. H. Ladendorf, Phoenix, Ariz. attorney. A bill which is being proposed to Congress by a group of western mining lawyers would provide adequate prediscovery possessory protection, Ladendorf said. He added that basically the provisions of the act are consistent with the general mining law, except that a discovery of mineral is not required. Rights under the act would be initiated by the posting of a notice of location, with the further requirement that within 180 days thereafter the claim must be monumented and the notice of location recorded. He said the primary purpose is to give locators of exploration claims the exclusive right to explore for mineral on the land covered by the claims for a limited time and to occupy the land for that purpose, and at the same time to protect against fraudulent holding of large areas of public domain by speculators. Also on the program were Russell H. W. Chadwick, geologist and attorney, Bear Creek Mining Co., Spokane, "Future Mineral Resources and the Withdrawal Problem"; and Clark M. Senior, attorney, Salt Lake City, "Pre-Patent Rights—Can You Dig This or Cut That?"

The convention's resolutions committee which spent most of its time working out recommendations for gold, silver and monetary policies, also came up with several other important resolutions which were approved by the convention. The principle of multiple use of public lands was backed in one resolution which voiced opposition to withdrawal of land from entry under the mining laws, except in cases where it can be established that the withdrawal is more important to the national welfare than the full discovery and development of the area's mineral resources. Wilderness withdrawals were flatly opposed and the group also opposed establishment of new national parks, unless locations and access are permitted under the mining laws. The resolution also asked that all Federal responsibilities affecting non-fissionable mineral resources be transferred to the Interior Department.

The organization's labor resolution called for the application of anti-trust laws to unions, voluntary unionism, collective bargaining free of federal compulsions, prohibition of mass picketing, a ban on the use of union funds for political activities, and a requirement that strikes must be approved in a supervised secret ballot election of all employees.

Opposition to construction of any dam on the Pend Oreille river that would affect mining operations in the Metaline district of northeastern Washington was reiterated in another resolution. Seattle City Light and the Pend Oreille County Public Utility District both are seeking Federal Power Commission licenses for dams in the area. The projects are opposed by mining interests because of the potential flood threat to underground workings in lead-zinc properties.

Assurance of local control of water and air pollution control programs was urged in another resolution. The organization also singled out three retiring U.S. Senators with resolutions expressing appreciation of their efforts in behalf of the mining industry. These are Sen. James Murray (D-Mont.), Sen. Joseph O'Mahoney (D-Wyo.) and Sen. Thomas Martin (R-Iowa).

Officers reelected were E. K. Barnes, Spokane, president; Ross D. Leisk, Spo-

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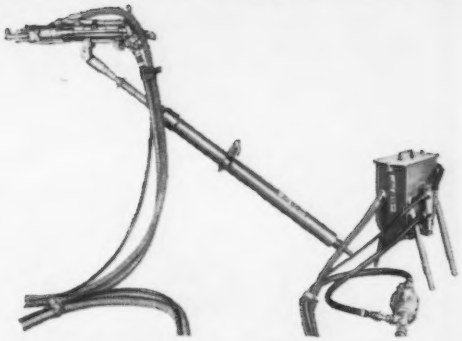

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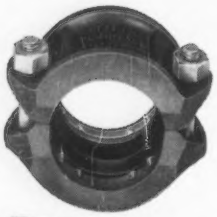

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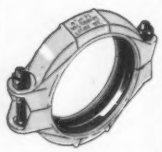

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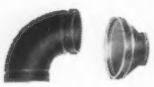

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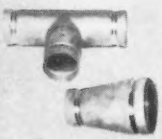

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NWMA *(Continued)*

kane, and M. C. Brown, Kellogg, vice presidents; Frank N. Marr, Spokane, treasurer, and Robert J. Towne, Spokane, secretary. Amy Satterstrom was renamed assistant secretary. Five new members of the board of trustees were named: Jens Jensen, Spokane, president of Pend Oreille Mines and Metals Co.; James A. Pike, Spokane, manager, Dawn Mining Co.; William D. Nesbeitt, Spokane manager, Allis-Chalmers Manufacturing Co.; John S. McIntosh, Nelson, B.C., general manager of Sheep Creek Gold Mines Ltd.; and Harry F. Magnuson, Wallace, Idaho, vice president of Lucky Friday Silver-Lead Mines.

Improvements in Montana mining and metallurgical operations of the Anaconda Co. were outlined by Edward D. Tierney, assistant vice president of the company, and Martin K. Hannifan, manager of the Butte mines, before the Northwest Mining Assn.'s annual meeting in Spokane.

Tierney told of improvements made in Anaconda to increase the efficiency of the plant all along the line from the unloading to the final treatment of ores. He reported that changes made in recent years in the concentrator raised the capacity of the mill to 36,000 dry tons per day and increased the grade of the concentrates. "The zinc concentrator recently has been adapted so it may be used on copper ores when zinc ores are not being processed," he said. "Use of the zinc facilities on copper ore gives a total capacity of over 41,000 tpd."

Important to the Anaconda operations, he said, is a new hydroseparator and a 370-ft Dorr thickener which will soon go into operation for the recovery of water for reuse in the concentrator.

"Not only will water be recovered but chemicals, such as lime, will be returned with the water", he explained. Some 17-million gpd, or about 30% of the total water used, will be recovered, Tierney reported.

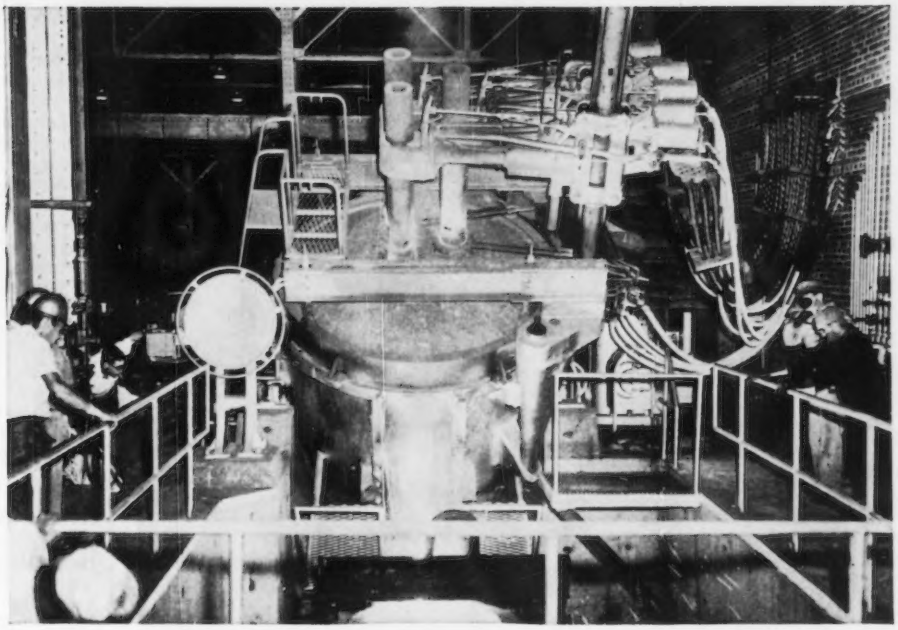
Among the principal improvements at Great Falls he mentioned the following:

New zinc concentrate bins have been installed and a conveyor system to the roasters has replaced the old tramming system to make a cleaner and more economical operation. Plans are being made to improve the calcine handling system. The old brick flues are being replaced with steel balloon flues in the roaster.

In the copper refinery about two thirds of the lead-lined wooden tanks have been replaced with integral concrete tanks with renewable wood bottoms and lead lined. When this work is completed the electrolytic copper refinery will have a capacity of over 15,000 lb per month.

Hannifan told the mining group that present operations in Butte are confined exclusively to copper ore production, "although considerable ore reserves in the zinc and manganese mines await a favorable market."

He said low-grade mining methods have surpassed high-grade vein mining in production of copper, "but the Butte district has orebodies with many years'



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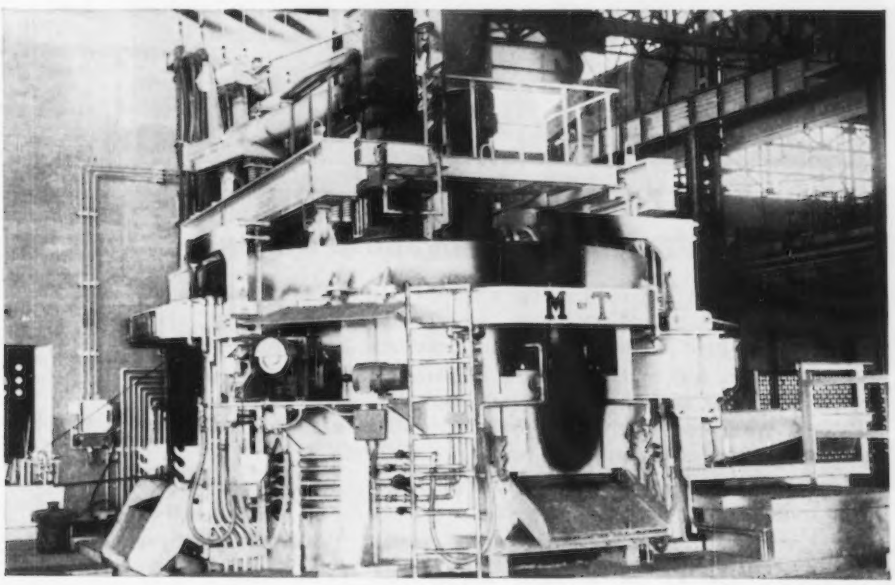

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NWMA *(Continued)*

reserves amenable to mining by each of three methods (vein stoping, block caving and open pit).

Hannifan said that as a result of data collected and knowledge gained by the geological department of the complex Butte vein system "we can project with reasonable assurance below and beyond the present development." The current program of shaft extensions and haulage systems, involving a large expenditure to prepare for deep-level mining, "is based on substantial evidence of the zone of copper mineralization expanding in depth."

"In our opinion," he said, "the problem before us is not ore reserves, but how to continue profitable exploitation of the metal resources nature provided in the Butte district."

Anaconda Options Nevada Beryllium-Bearing Lands

ANACONDA Co. has acquired options on what is probably the nation's largest, presently known, deposit of disseminated beryllium ore 40 miles southeast of Ely, Nev.

In obtaining the options on 103 claims covering about 2,000 acres in the Mount Washington Mining district from Mt. Wheeler Mines, Inc., Salt Lake City, both firms avoided any discussion of details of the option-purchase contract or of future plans.

Anaconda will start to work immediately in developing ore reserve by drifting and cross-cutting along a number of ore shoots in the "Wheeler limestone." The properties previously had been explored for tungsten and, earlier, lead and zinc.

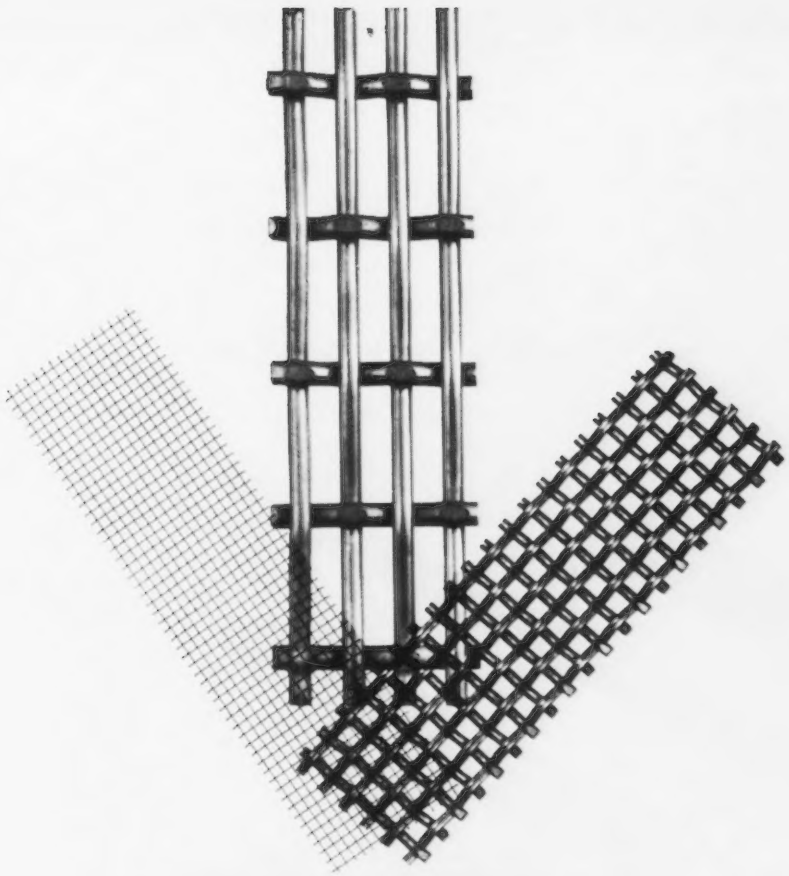
Principals in Mt. Wheeler include its president, James D. Williams, Salt Lake mining man; the Herbert Hoover family interests of New York City; Jeremiah Millbank interests, also of New York and American Zinc Lead and Smelting Co., St. Louis, Mo.

Anaconda previously had acquired interests in some 16 claims covering about 300 acres from the Jeppson family of Ely. The Jeppson claims are immediately north of the Mt. Wheeler properties.

Anaconda Co. is the first of America's major mining firms to acquire a raw materials stake in the growing domestic beryllium search. But other major firms such as United States Steel Corp., E. I. du Pont, Food Machinery & Chemical Corp., Cerro de Pasco Corp. have been active in probing for beryllium raw materials in the Intermountain West.

Vitro Minerals Corp., subsidiary of Vitro Corporation of America and Beryllium Resources, which as a result of merger with Dynamic Metals Corp. will have Brush Beryllium Corp. as a stockholder, are among those with substantial claim holdings in the Topaz Mt. beryllium ore area in western Utah.

At the same time, the United States Bureau of Mines at Salt Lake City confirmed that, as a result of continuing studies, it had developed a bulk flotation



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ANACONDA *(Continued)*

process for the treatment of the Mt. Wheeler beryllium ores.

The bureau, which has obtained patents on this process and plans publication of its work shortly, confirmed that the one per cent (average) grade of BeO in Ore at Mt. Wheeler properties had been concentrated to 20 to 22 per cent BeO. Recoveries are in the "vicinity" of 80%, the bureau said of this process.

Within the past weeks, the United States Geological Survey in professional papers 400-B, described the Mt. Wheeler properties as "large," from beryllium standpoint. Others have said that reserves developed to date are "substantial." H. K. Stager, Menlo Park, Calif., in describing the Mt. Wheeler ores gives those ores the average 1% BeO grade.

New Mexico May Toughen Uranium Tax Exemptions

THE NEW MEXICO legislative finance committee feels that uranium operators have abused the privilege of exemptions under the present law and reportedly will recommend that the 1961 legislature eliminate all deductions now allowed for severance taxes paid by uranium companies.

The committee did not recommend specific adjustments of the tax rate.

A move to ask the national Congress for equal treatment under Federal Mining Royalty laws was also proposed by the committee, which noted that Alaska receives 90% of all royalty payments for its lands while New Mexico gets only 37½% of such payments.

U. of Calif. Chemists Treat Californium

PREPARATION of the first pure compounds of the man-made element californium (element 98) was announced last month by Glenn T. Seaborg, eminent nuclear chemist, Nobel Laureate, and Chancellor of the University of California, Berkeley.

Preparation and identification of the compounds was carried out by Burris B. Cunningham and James C. Wallman of the University's Lawrence Radiation Laboratory. Three separate californium compounds—californium trichloride, californium oxychloride, and californium oxide—were prepared by treatment with hydrochloric acid and steam at high temperatures.

Seaborg said the feat of carrying out identifiable chemical reactions with such minute quantities of material—samples weighing about a ten-millionth of a gram—was accomplished as a result of the extraordinary perfection in the past year, by Cunningham and his colleagues, of techniques for working on the "submicrogram" scale.

Grand Junction Office Asks Sale of Ore Mill

GRAND JUNCTION Operations Office of Atomic Energy Commission proposes sale of both its Monticello, Utah 300 tpd uranium mill and its pilot plant at Grand Junction, Colo.

The mill is carried on AEC books at $5.6-million while the pilot plant is valued on books of the Commission at $1.8 million.

A spokesman at Grand Junction said AEC had not yet approved sale of the two facilities—only that Grand Junction Operations Office had "recommended" their sale.

Previously, the Commission had announced intention of keeping the Monticello mill on standby when it was closed in 1958.

The AEC spokesman asserted the mill would be "cannibalized" as to "process units" and sold only to those in the domestic uranium industry. This apparently means that acid digestion units, caustic unit, RIP units each would be sold separately. Such a procedure would obviate a unit bid by someone wishing to move the mill elsewhere, intact, as it were.

As expected, the San Juan Chamber of Commerce is seeking sale of the mill

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In the West: **THE COLORADO FUEL AND IRON CORPORATION** — Albuquerque • Amarillo • Billings • Boise • Butte • Denver • El Paso • Ft. Worth • Houston Kansas City • Lincoln • Los Angeles • Oakland • Oklahoma City • Phoenix • Portland • Pueblo • Salt Lake City • San Leandro • Seattle • Spokane • Wichita

In the East: **WICKWIRE SPENCER STEEL DIVISION** — Atlanta • Boston • Buffalo • Chicago • Detroit • New Orleans • New York • Philadelphia

MILL SALE (*Continued*)

to some qualified operator. But in arranging ore contracts and in modification of shipping of ore from districts tributary to Monticello in recent years, the AEC indirectly arranged ore diversions to other mills in Utah.

Despite tenders via discussions, AEC refused in 1957-1958 to discuss sale of the mill to operators who proposed to run it on eligible ores.

Recently in the industry there has been talk of running ineligible ores from existing reserves and selling same on the world market. But AEC controls permitting of such sales.

There are substantial reserves of uranium ore in area tributary to the Monticello mill which were discovered and developed after Nov. 24, 1958. AEC in its 1962-1966 concentrates purchase program does not buy concentrates from ores discovered after the Nov. 24, 1958 date.

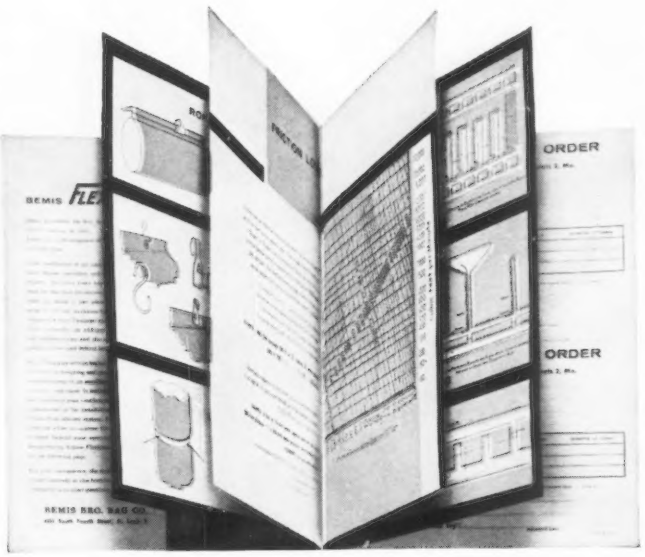
Wisconsin Plans 1961 Aeromagnetic Survey

WISCONSIN Governor Gaylord Nelson has indicated that he will ask the 1961 Legislature for funds to conduct an aeromagnetic survey of geological deposits under the state's surface, particularly ores for industrial purposes, which are hidden by a heavy glacial layer.

A proposed bill, to be drafted by the State Department of Resource Development, would have the Wisconsin Geological Survey do the work with an airborne team of five men.

In a plan of the proposed survey, submitted by State Geologist George Hanson to Resource Director David Carley, the total cost of the project was estimated at $110,000. Hanson said the survey would take three years to complete if only one plane was used.

The survey would result in a map of the geological structure under the state's earth surface, obtained by readings from magnetic instruments in the plane.



Here's a book about mine ventilation tubing . . .

This book is interesting, concise. You can read it, cover to cover, in just 8½ minutes—but you'll find it valuable for periodic reference for a long time . . . as an information source about ventilation equipment, friction loss and air flow calculations, ventilation tubing installations.

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BEMIS

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SALES OFFICES IN PRINCIPAL CITIES

Alaska Studies Draft Of State Mining Law

PRELIMINARY hearings on a draft of mining lands regulations for areas which the new state will acquire from the Federal public domain were held in November in Ketchikan, Juneau, Fairbanks, Nome and Anchorage. Several recommendations were made on the basis that the state now has a chance to start with "a clean slate."

It is expected that the redraft will eventually include the following:

1) a maximum size of 160 acres for prospecting sites, with a maximum of six allowed in any recording district; 2) a maximum size of 40 acres for mining claims, with no extralateral rights, no distinction between lode and placer, no limit to the number of claims, $100 worth of assessment work per claim per year.

IN THE U.S.

ALASKA

Glacier Mining Co. announced that development work on a molybdenum deposit in the Hayes Glacier area has been suspended indefinitely. According to the spokesman, exploration and sampling has proved that a sizable deposit exists in the undeveloped region 60-80 miles northwest of Anchorage but development of the deposit is hindered by lack of power.

A 67-oz gold nugget was found on Gaines Creek in the Ophir Mining District this summer. The find could not be confirmed, however, a number of mining people from the Ophir District insist they saw the nugget.

COLORADO

Don H. Peaker, president of U.S. Beryllium Corp., Pueblo, said beryllium ore has been found in the old Redskin Mine, a one-time molybdenum mine, west of

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Rosita, Coah., Mexico

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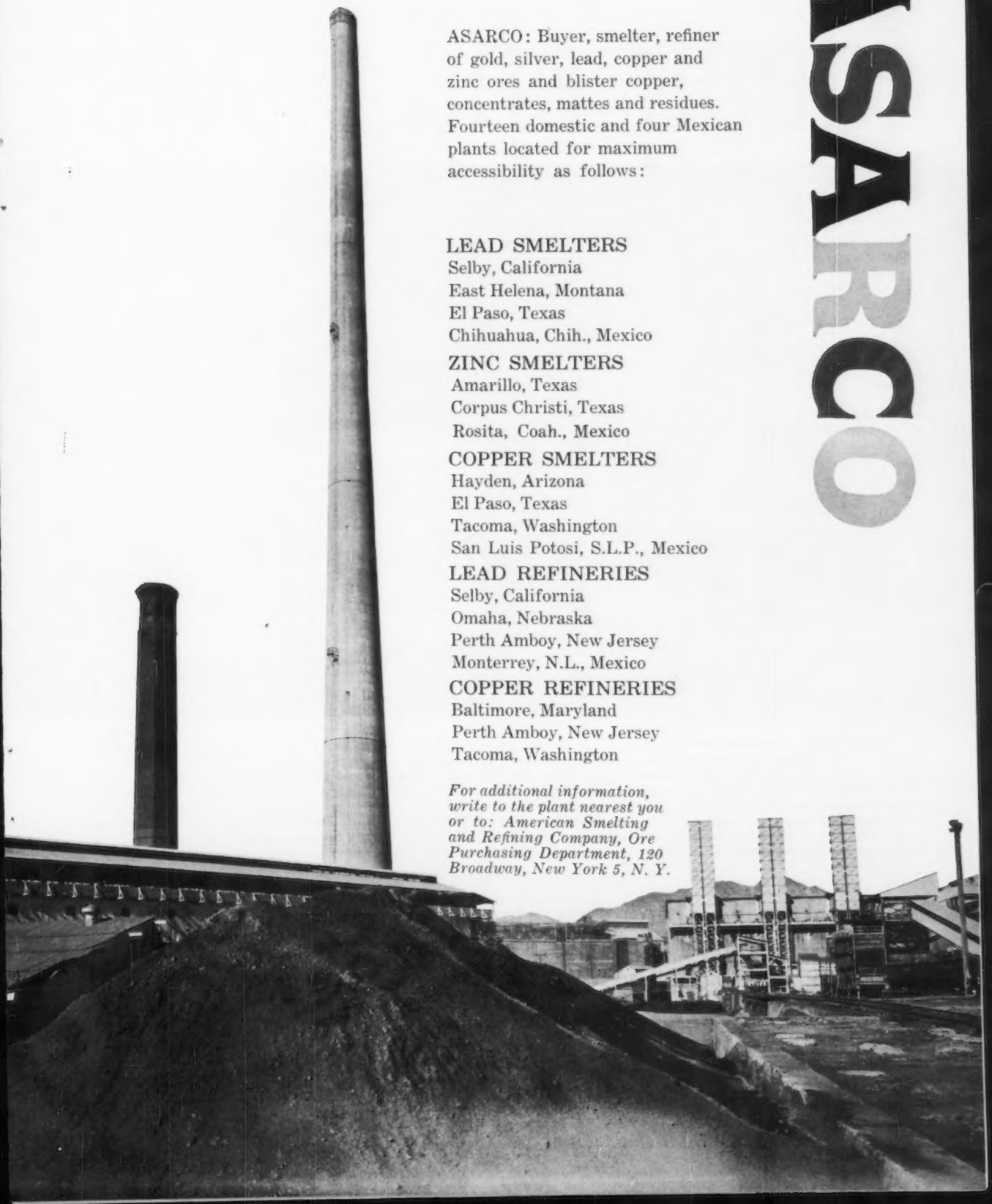
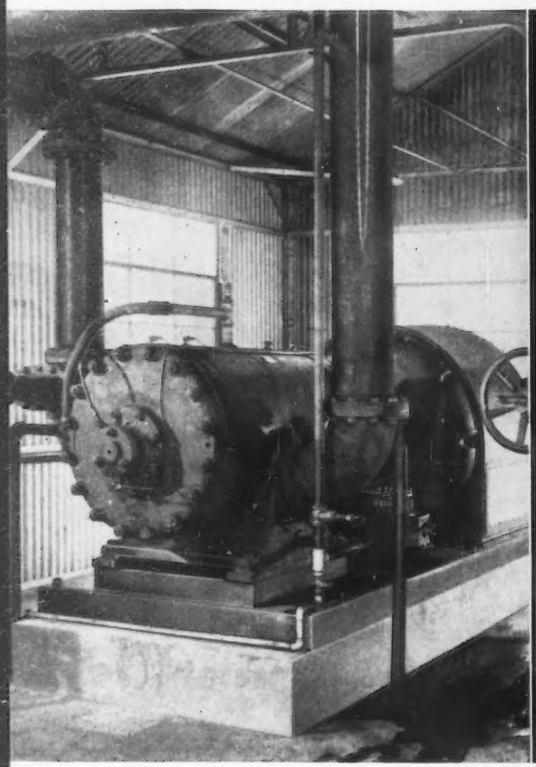
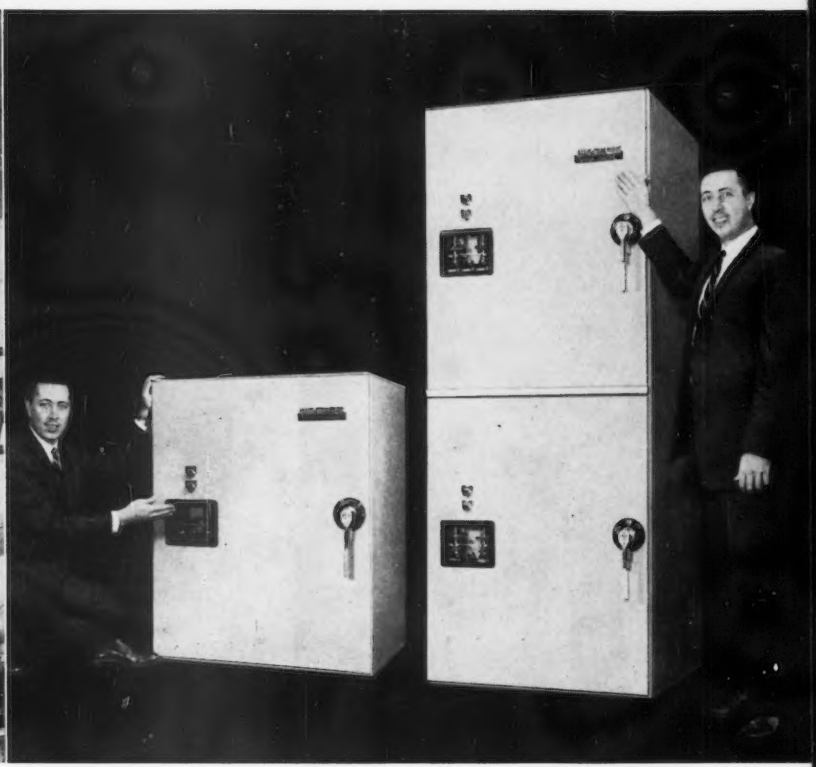
For additional information, write to the plant nearest you or to: American Smelting and Refining Company, Ore Purchasing Department, 120 Broadway, New York 5, N. Y.



ideas and news:





Constant vacuum . . . year after year: Ro-Flo vacuum pumps with sliding-vane rotary design eliminate operating losses inherent in reciprocating machines. Centrifugal force keeps vanes in close contact with cylinder walls, automatically compensating for wear. In addition, few moving parts required, reduce wear, simplify maintenance.

So low, two fit where one used to go: This new SpaceMaker control center is the first completely new 2- to 5-kv motor controller development in more than a decade. New compact two-high design can cut floor space requirements in half. Complete drawout construction makes it the safest, most easily accessible controller on the market. New flame-retardent, track-resistant Super Pyro-Shield insulation adds to reliability, reduces size and weight. And, the all-new roll-out contactor has been designed specifically to cut maintenance time and costs.

Which of these productive ideas could be working for you?

A system that makes low-grade ore valuable. New motor controls that save space. Where could your company apply these? What about all the rest of the idea-filled products which result from the A-C "usefulness" concept of design? Have an application? Call your A-C representative for information. Or write Allis-Chalmers, Industrial Equipment Division, 906 S. 70th St., Milwaukee 1, Wis.

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A-1403

From low-grade ore . . . ideal blast furnace feed: Now processing 1000 ltpd of beneficiated, finely powdered concentrates from low-grade iron ore, the new Grate-Kiln system produces these iron-rich pellets. Easy to ship and ready to use as blast furnace charge, these pellets are also economically produced. Costs are kept low by a unique system of heat recovery and process control.

Keeping pellets optimum sized: Installed as part of the first Grate-Kiln system used for iron ore processing, this specially-designed A-C vibrating screen "sizes" pellets from the Allis-Chalmers balling drum, permits only properly sized balls to pass to the system for heat processing. Years of experience in handling screening problems like this have resulted in a wide range of screen sizes and features.

Rugged primary gyratory crusher: This 60-inch Superior gyratory crusher crushes tons of hard, abrasive ores daily — proof of its tough construction. But, in addition, this machine requires no downtime for resetting to compensate for mantle and concave wear. The Hydroset control, exclusive with A-C cone and gyratory crushers, permits instantaneous wear — compensating adjustment while in operation.

A-C INDUSTRIAL EQUIPMENT DIVISION: motors, generators, controls, rectifiers, pumps, compressors, crushers, mills, screens, kilns, coolers, industrial systems.

OTHER A-C PRODUCTS: thermal, hydro and atomic electrical generating equipment; switchgear, transformers, unit substations; tractors, earth-moving equipment, engines, lift trucks.

ALLIS-CHALMERS

COLORADO *(Continued)*

Pike's Peak in Park County, Colorado.

Peaker said the Redskin is 2½ miles northeast of the Boomer Mine, a beryllium ore producer since it was reactivated in 1956 by Peaker's firm.

He said U.S. Beryllium has contracted with Mineral Concentrates and Chemical Co., Loveland, for processing of the ores into beryllium oxide at its mill. Peaker said the contract is for beryllium ores starting at 5% BeO content. In the year ended June 30, 1960, the Boomer mine produced 1200 tons of ore.

Mineral Concentrates said it is obtaining oxide purity as high as 99% from the Boomer and Redskin ores. The firm said it has been successful in processing ores of as low as 3% beryllium oxide content.

Peaker said the beryllium ore in the Redskin Mine occurs in the form of altered granite or greisen.

George M. Ernst, vice president of Transmount Mining Ventures, Inc., of Colorado Springs, said production of tungsten ore has started from a mine five miles north of Lake George. Concentrates from the mine show 14% tungsten content, he said.

Ernst said the Transmount properties have some 600 ft of surface exposure on the operating vein. The average width on the surface is around 18 in. with a proven depth of 120 ft vertically on the vein. The ores will be trucked to Boulder for smelting.

Rico Argentine Mining Co. had net loss after depreciation of $210,178 for fiscal year ended June 30, 1960, according to Sherman B. Hinckley, Salt Lake City, president of the lead-silver-zinc mining firm.

This loss, after depreciation, compares with similar loss for fiscal 1959 of $99,119.

The company reported net profits for both fiscal years before depreciation deductions.

Mr. Hinckley told shareholders in the annual report that "while the lead-zinc picture is not too promising from a price standpoint, your company can produce profitably and still do a reasonable amount of development work under present conditions."

He noted that Rico Argentine's sulphuric acid production suffered from a "disastrous" fire at Rico facilities in January 1960.

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IDAHO

Drifting at the Dayrock mine of Day Mines, Inc., in the Coeur d'Alene district, has developed an ore length of 435 ft made up of four segments which are somewhat separated by faults, Henry L. Day, president and manager, told stockholders. One raise followed the ore upward for 150 ft, reaching the elevation of the 950 level where it shortly will be crosscut from pre-existing work, Day said.

Salmon River Scheelite mine near Clayton has resumed mining and milling on a small scale after having been closed down since their DMEA exploration program was completed a year ago. The price of tungsten has risen to a point where operations are now possible, Harvey Penny of Clayton, president of the company, said.

Exploration of the Chester fault zone on the 4000-level of the Sunshine Mining Co. property near Wallace, has disclosed a heretofore undeveloped orebody of unknown dimensions but to date showing better-than-average width and grade, Robert M. Hardy Jr., president of the company, reports. He said also that exploration by drifting and diamond drilling on the Mine's 3700-level has also indicated a limited ore shoot of good grade and width and that additional development work is under way there to determine the full extent of the discovery.

MICHIGAN

A Canadian contractor is sinking a new shaft on the White Pine Copper property, and the company's $2-million exploration program about 2 miles southwest of the present mine is continuing. Some 1600 men are now employed at the mine, which is now at the 400 ft

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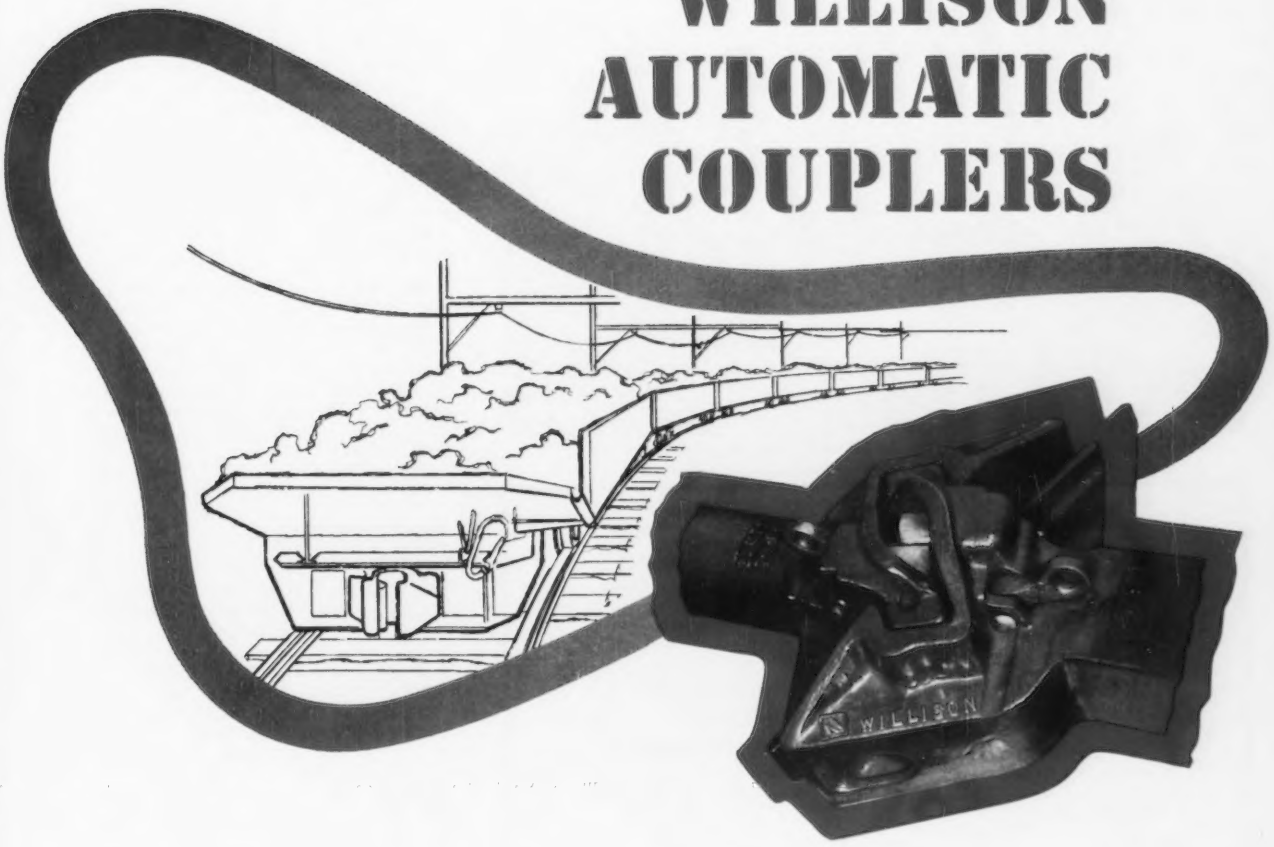

Willison Couplers automatically couple at either end of mine car or locomotive even under extreme curve conditions . . . permit higher train speeds because close coupling eliminates damaging slack . . . provide utmost safety for personnel because there's no need to go between cars to couple or uncouple. There are many technical reasons, too, why Willisons are your best buy. Let our representatives tell you all about them.

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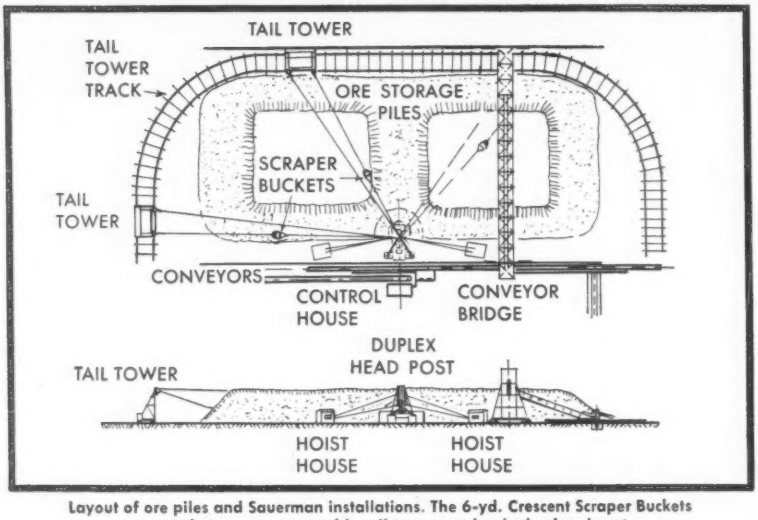
Reclaiming Ore By Remote Control

SAUERMAN DRAGSCRAPERS HAUL 2300 TONS PER HOUR

One of two DragScraper Machines reclaiming from storage piles of an African mining company.



Layout of ore piles and Sauerman installations. The 6-yd. Crescent Scraper Buckets operate between two movable tail towers and a duplex head post.

At this African installation, two 6-yd. DragScraper Machines reclaim ore at 2300 tph. on average hauls of 125 ft. They feed a common hopper which supplies a belt conveyor system used to load the ore onto ships. The Scrapers can be worked from the same pile or shifted to opposite ends of the 100,000-ton storage area by means of two tail towers which travel the perimeter. Both buckets and tail towers are remotely controlled.

Ore from the mine is conveyed to a traveling bridge where a tripper line conveyor places the ore on the stockpiles. Although the ore becomes sunbaked and forms crusts up to five feet thick, the Scraper Buckets operate without difficulty.

DragScraper Machines are economical handlers of bulk material for both indoor and outdoor installations. Sizes from ⅓ to 15 yds. match your requirements. Write or call for our recommendations and further information.

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MICHIGAN (*Continued*)

level, with operations on a three-shift, seven-day week.

The Bristol (Inland Steel) and Tobin (Republic Steel) at Crystal Falls were first to close, on Nov. 4th. Pickands Mather & Company's Buck mine at Caspian ended its shipping on the 7th. The last ore from the Gogebic and Marquette ranges arrived at the Escanaba docks on the 11th. Inland Steel Company's Sherwood mine at Mineral Hills wound up Nov. 18 and the M. A. Hanna Co. mines finished on the 19th. Thus several weeks of potential shipping from this Lake Michigan port were unused.

Inland Steel Co. is now operating its underground mines on a 4 days per week schedule instead of the 5½ day week. Its mines include the Morris and Greenwood on the Marquette range, the Sherwood and Bristol on the Menominee range in Michigan and the Armour No. 2 at Crosby on the Cuyuna range of Minnesota.

MINNESOTA

The Pittsburgh Steamship Division of U.S. Steel Corp. closed its 1960 shipping season Nov. 13. On that date the Irving S. Olds took on her last cargo at the Two Harbors docks of the DM&IRR. Of the 53 Pittsburgh Steamship Div. boats which operated this season, 21 will winter at the Duluth-Superior harbor. The Great Northern RR docks at Superior, Wis. loaded their last cargo Nov. 17 with ore from the Cleveland Cliffs Iron Co. The season ended at Silver Bay (Reserve Mining Co.) and at Taconite Harbor (Erie Mining Co.) on Nov. 20.

Taconite Harbor shipped 5½ million tons in 1960.

This season of 1960 has had one of the earliest closing dates on the records.

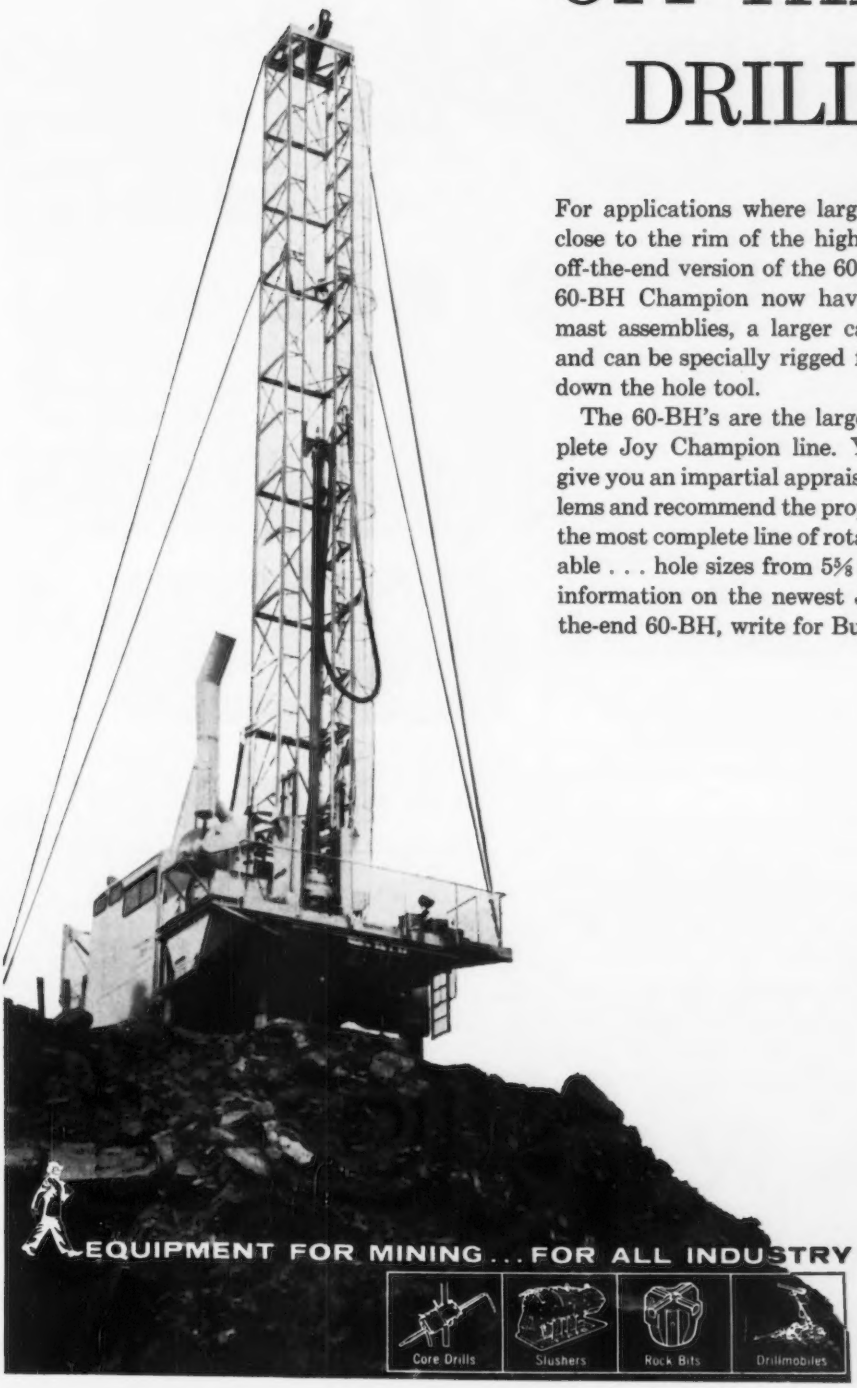
The 22d annual mining symposium sponsored by the University of Minnesota was held in Duluth Jan. 10 and 11. About 700 attended the meetings which were held in connection with the Jan. 9 meeting of the American Institute of Mining and Metallurgical Engineers. Speakers on the program were: Robert Linney, Hoyt Lakes, president, Reserve Mining Co.; Fred Vines, Cleveland, chief engineer of the M. A. Hanna Co.; Christian Beukema, Duluth, president. Oliver Iron Mining Div. and J. S. Wilbur, Cleveland, vice-president, Cleveland-Cliffs Iron Co.

Subjects which received particular attention were: the influence of taxes on new investments for iron ore and taconite concentration in Minnesota; basic research in the iron mining industry, and what is being and can be done to meet the competition of foreign ores.

Cleveland-Cliffs Iron Co.'s Holman group mine at Taconite on the Mesabi range has added a $750,000 scrubber section to its plant which has been in operation this season (See E&MJ, September,

JOY 60-BH CHAMPION

OFF-THE-END DRILLING



For applications where large blast holes are sunk close to the rim of the highwall, Joy offers a new off-the-end version of the 60-BH. All models of the 60-BH Champion now have heavier crawler and mast assemblies, a larger capacity air compressor and can be specially rigged for optional use with a down the hole tool.

The 60-BH's are the largest models of the complete Joy Champion line. Your Joy engineer can give you an impartial appraisal of your drilling problems and recommend the proper Joy Champion from the most complete line of rotary air blast drills available . . . hole sizes from 5⅝" to 12". For complete information on the newest Joy Champion, the off-the-end 60-BH, write for Bulletin 2655-4

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MINNESOTA (*Continued*)

p 110). From 500 to 700 tons per hour of crude ore, from minus 2 in. to plus 60 mesh, is fed to the 12½ ft dia scrubber drum. The scrubbed ore is treated in two 66 in. screw type classifiers, heavy media and cyclones. The fine material from the classifiers is deslimed and passed through spirals. First opened in 1907 by Oliver Iron Mining Co., the Holman group (Bingham, Holman Brown and North Star) has shipped approximately 29.5 million tons.

The new 36-car thawing unit installed by the DM&IRR at the Two Harbors docks this year was given its first brief try-out Nov. 10th. It was found so much superior to the old method that the steaming process will be completely replaced by the new unit. Other new thawing plants installed this year have had little opportunity to test their efficiency on frozen ore because of the early closing of ore shipments.

M. A. Hanna Co. has acquired a new lease to the Mississippi No. 1 mine at Keewatin, west of Hibbing. The property, operated by Hanna in 1942-49; by the Haley-Young Mining Co. in 1952; the Missco Mining Co. in 1953 and by Pacific Isle 1955-'57, adjoins the Sargent on the north. Last shipment from the mine was made in 1957.

Forty-five members of the Lake Superior Industrial Engineering Society were guests Nov. 16 of L. E. Johnston, works manager of Erie Mining Co. After viewing a film the group toured the mines and plant. A dinner in Virginia was followed by talks given by Terry White, Northwest Paper Co.; Charles Matson, Erie Mining Co. and Robert Baker, Pickands Mather & Co. Each speaker dwelt on the application of industrial engineering principles to his particular work.

Robert Wallace, mining engineer, at a meeting of the Hibbing Chamber of Commerce Nov. 15, said that there are now 80 ore treating plants in Minnesota. Three out of five miners, he said, are mining or treating low grade material which now accounts for more than half of the state's yearly production. "Tomorrow, if Minnesota is to be competitive in the world's markets, she must have still more ore treatment plants."

Cleveland-Cliffs Iron Co. will have winter stripping programs at its Canisteo, Holman and Hill-Trumbull mines on the west Mesabi range. During the winter a new cyclone unit will be installed at the Canisteo mine at Coleraine, and a reject conveyor and stacker at the Hill-Trumbull mine at Marble.

Shenango Furnace Co. has acquired the 50% interest in Snyder Mining Co. which had been owned by Crucible Steel Co. since the Snyder Mining Co. was organized by the two companies in 1930.

The new semi-taconite plant of Oliver Iron Mining Division at Trout Lake,

ACCURATE, LIGHTWEIGHT, RUGGED... the perfect combination for efficient, convenient engineering work on roads, bridges, construction and tunnels. IMPORTANT FEATURES include 24 or 28 power telescope, internal focusing, coincidence-reading tubular level, and telescope rotatable around its longitudinal axis for rapid checking of level adjustments.

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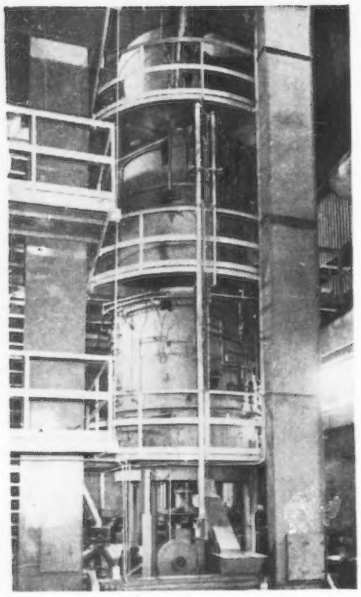

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MINNESOTA *(Continued)*

near Coleraine, has begun experimental production. Crude ore, before being fed into the brick-lined 4½ ft diameter x 50 ft long steel tube, is heated to 950 to 1225 F. Carefully controlled conditions within the tube change the nonmagnetic semi-taconite to a highly magnetic product. The experimental kiln has a capacity of five tons per hour. Product of the kiln must be ground, concentrated and then agglomerated to complete the process, these latter operations being similar to those employed at magnetic taconite plants on the eastern Mesabi. The Oliver believes that its pilot plant will provide the engineering data necessary to determine the commercial possibilities of the substantial quantities of semi-taconite on the Minnesota ranges.

Although employment at M. A. Hanna Co. mines for this winter is expected to be somewhat below the average, some stripping operations and normal plant repair work are planned for the Hunner, Patrick group, Mississippi group, Pierce, Morton, Douglas, Robert and west Cuyuna group. A new tailings pond basin is being made at the Douglas. The new semi-taconite experimental plant at Cooley is expected to be completed and put into service this winter.

MONTANA

Department of Interior announced on Dec. 7 it has approved an OME loan to Northern Milling Co., Inc., of Townsend.

The firm was authorized to spend up to $102,300 on exploration work for lead and zinc in Broadwater County. The Government will contribute one-half, or $51,150, of the cost.

The contract was the third to be awarded by OME in Montana since the program began in 1959, bringing government exploration assistance in the state to $69,565.

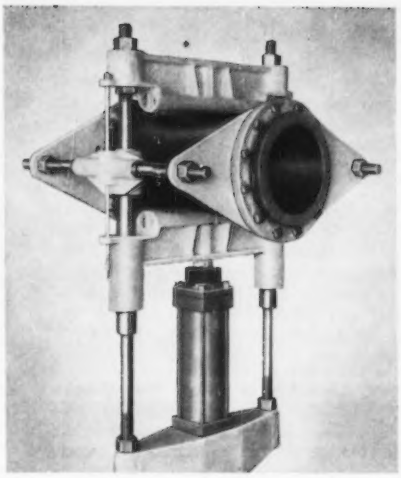
NEVADA

American Exploration and Mining Co. has started the second phase of an exploration program on Goldfield Consolidated property in Goldfield. Hatfield Coudey is chief geologist, and drilling is being done by Jerry Kennedy, of Tonopah, under direction of William Clark, San Francisco geologist.

Desert Minerals Corp., a recently organized firm of Yerington residents, has launched an extensive drilling program in Pumpkin Hollow to determine the extent of iron ore deposits on 50 claims embracing 1500 acres. The operation is near the eight core drilling rigs being operated by Columbia Iron Ore. Co., a subsidiary of U.S. Steel Co. Officers of Desert Minerals Corp. are Carl Roan, president, Louis Mattice, vice president, Geraldine Roan, secretary, and Ervin Mills, treasurer.

Bognadich Development Co. is produc-

AUTOMATED *Hydral-60* PINCH VALVE SYSTEMS



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- Rubber, neoprene and special compounded rubber sleeves for corrosive and abrasive pulps and liquids.
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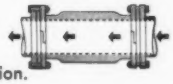

- Split flanges and patented Flex Seal ends assure perfect seal.
- Rugged, heavy duty construction for most severe service and long life.
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ing mercury ore from the Cahill mine in the Poverty Peak district near Paradise Valley in Humboldt County. R. E. Bradford is engineer in charge, and four men are employed at the property. The Bognadich Co. also operated mines and mills near Mountain City in northern Elko County, where they are producing values in lead, silver and gold.

Louis V. Cirac, of Tonopah, and John Lambert, of Pacoima, Calif., have obtained a lease and option on the Keystone claims in the Manhattan district of Nye County, and have already started developing the property. Chief values are in gold and silver, and Cirac and Lambert are at present looking for housing that can be moved to the site to accommodate a crew of eight men.

NEW MEXICO

Construction of a $2.2-million skip hoist system will begin soon at Kennecott Copper Corp.'s Chino open pit.

Officials of Kennecott's Chino Mines Division said a contract for some $2,350,000 has been awarded to the National Iron Co., Duluth, Minn., for construction of the hoist. Work is expected to be completed next September.

The Chino skip hoist will be the largest such system ever built, company officials said. Basically, it will consist of two 40-ton skips or cable-drawn cars traveling on an inclined track 1400 ft

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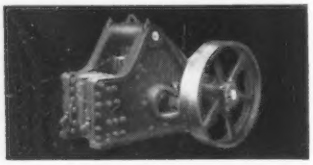
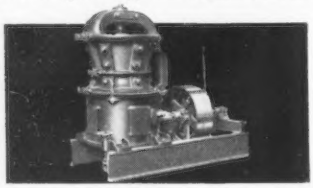
Sturtevant crushing and grinding machinery answers the long life top-load production problem for medium to small size plants. Many Sturtevants have been operating above rated capacities for more than 25 years, and *without a major repair.*

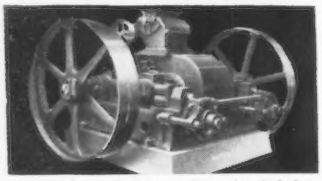
"Open-Door" design gives instant accessibility where needed — makes cleanouts, inspection and maintenance fast and easy. Machines may be set up in units to operate at equal quality and capacity.



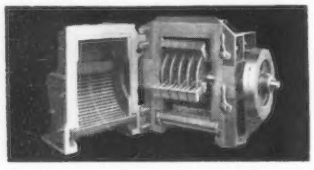
Jaw Crushers — Produce coarse (5 in. largest model) to fine (⅛ in. smallest model). Eight models range from 2 x 6 in. jaw opening (lab model) to 12 x 26 in. Capacities to 30 tph. All except two smallest sizes operate on double cam principle — crush double per energy unit. *Request Bulletin No. 062.*



Rotary Fine Crusher — Reduce soft to medium hard 3 to 8 in. material down to ¾ to 1¼ in. sizes. Capacities up to 30 tph. Smallest model has 6 x 18 in. hopper opening; largest, 10 x 30 in. Non-clogging operation. Single handwheel regulates size. *Request Bulletin No. 063.*



Crushing Rolls — Reduce soft to hard 2 in. and smaller materials to from 12 to 20 mesh with minimum fines. Eight sizes, with rolls from 8 x 5 in. to 38 x 20 in.; rates to 87 tph. Three types — Balanced Rolls; Plain Balanced Rolls; Laboratory Rolls — all may be adjusted in operation. *Request Bulletin No. 065.*



Hammer Mills — Reduce to 20 mesh. Swing-Sledge Mills crush or shred medium hard material up to 70 tph. Hinged-Hammer Pulverizers crush or shred softer material at rates up to 30 tph. Four Swing-Sledge Mills with feed openings from 6 x 5 in. to 20 x 30½ in. Four Hinged-Hammer Pulverizers with feed openings from 12 x 12 in. to 12½ x 24 in. *Request Bulletin No. 084.*

**Reports Manager W. Carleton Merrill concerning Sturtevant Swing-Sledge Mill at James F. Morse Co., Boston.*

STURTEVANT
MILL COMPANY
101 Clayton St., Boston 22, Mass.

NEW MEXICO *(Continued)*

long. It is expected to move in excess of 1,000 tph of material.

OREGON

Dave Chase of Medford has moved his 10-ton Gould type rotary furnace from the Bonita mine to the War Eagle quicksilver mine in Jackson county and is mill testing small amounts of ore. The lower drift and shaft have been opened and the upper drift extended for about 60 ft to the east.

Harry Commers of Grants Pass shipped two carloads of copper-bearing vein quartz from the Copper Eagle mine in the Galice district, Josephine County, during October.

TENNESSEE

Aluminum Company of America announced the shutdown on Dec. 31, of a second potline at their large Alcoa smelter. Smelting works manager, G. H. Traylor, said the shutdown was made necessary by metal production in excess of current demands.

Seven potlines will remain in production after this latest curtailment. Approximately 100 workers are employed on each potline.

New Jersey Zinc Co. has a diamond drill exploration program underway at their Jefferson City zinc mine. The purpose of the exploration is to locate down dip extensions of ore presently being mined. All the ore being mined at the Jefferson City mine occurs in the limestone beds of the Kingsport formation (Ordovician age).

Joy Manufacturing Co., diamond drill contractor, is carrying out the New Jersey Zinc exploration program with two diamond drills.

UTAH

Federal Resources Corp., Salt Lake City, has accquired "controlling interest" in Col-U-Mex Uranium Corp., according to Nels W. Stalheim, Federal chairman.

Col-U-Mex is an Albuquerque, N.M. firm with producing properties in Utah's Big Indian district. The properties are operated on a 50-50 net profits sharing basis by Standard Metals Corp., Moab.

Bids will be opened on public sale of 7500 tons of vanadium pentoxide at 3 pm Jan. 25, 1961, Grand Junction Operations Office, Atomic Energy Commission, announced.

The fused V205 will be sold in 17 separate lots, ranging in size from 29,000 to 105,000 lb, but averaging 9,000 lb per lot.

The vanadium is in 30 and 55 gallon steel drums.

Bids are in nature of sealed quotations.

Last April, AEC sold at Grand Junction an initial 7500 tons of the V205 at $1 a pound.

Atomic Energy Commission said on Nov. 23 nearly half the air samples collected in 74 Utah uranium mines showed radiation three times the safe working level.

The survey, which took five weeks and included 224 air samples, may lead to a Government review of the mining hazards involved in working with radioactive elements.

The AEC said 48% of the samples were above the safe level. Correction measures are recommended when it reaches that stage, but mining may continue until it reaches 10 times the "safe" level. Ventilation is the usual means of correcting the gas which carries the radiation.

The survey covered 371 mines in Arizona, Utah, Colorado, New Mexico, Montana and Wyoming. Forty-two percent of the samples in New Mexico and Montana showed 10 times the safe level.

WASHINGTON

Production was suspended Dec. 1 at the Chewelah plant of Northwest Magnesite Co. The production shutdown will last about six weeks, Howard Ziebell, general manager, said. The action will mean the layoff of about 150 workers.

WISCONSIN

Eagle-Picher Co. reportedly may take over and reopen the old Singer Mine east of Dodgeville, in the Southwestern Wisconsin zinc mining area.

Dodgeville city officials had considered the mine as a possible source of water, because of seepage from the limestone ledges, but decided not to make further tests in view of the report that it may be reopened.

WYOMING

Petrotomics will open bids early next spring for construction of a uranium processing mill in the Shirley Basin area of central Wyoming, Norman Grant, project manager, has announced.

A pilot plant is now being built in Golden, Colo. Grant said the mill will use a new method of processing uranium ore.

The mill will be constructed near Petrotomics' open-pit mine now nearing completion.

The Colorado Fuel and Iron Corp. iron ore mine at Sunrise was shut down Nov. 27 until further notice.

The lack of orders for ore was given as the reason for the work stoppage.

It is the second time in the past four months that the mine has been shut down. Production was stopped from Aug. 21 to Sept. 25 because the stockpile of ore at CF&I's blast furnaces in Pueblo, Colo., was growing too large for the company's current orders.

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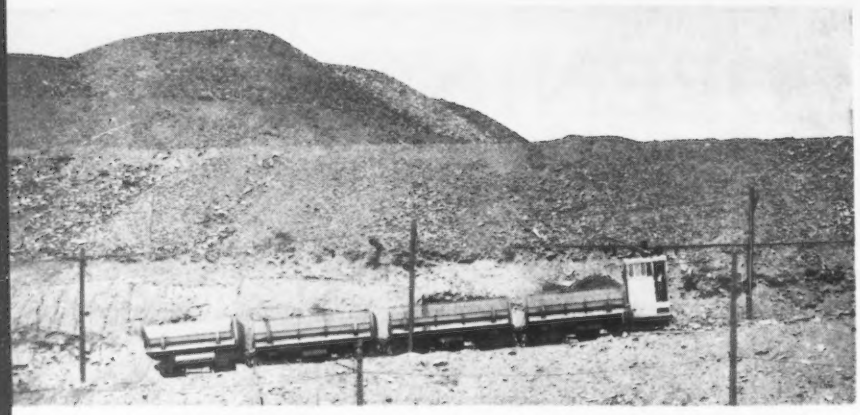

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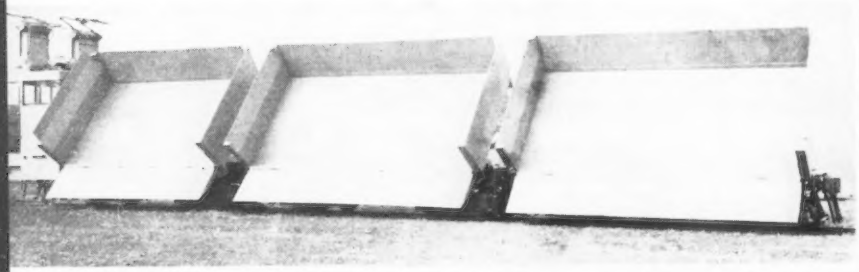
Controlled speed with electric braking down 10% grade. Saves brake shoe and wheel wear. Capacities 1000 HP to 3000 HP.



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IN CANADA

BRITISH COLUMBIA-NWT

International Iron Mines, Ltd. has signed a contract with Japanese steel interests to sell three million tons of iron ore to Japan. Shipments totaling 500,000 tons of beneficiated ore per year will commence in mid-1961. The ore will come from International's Zeballos mine on Vancouver Island.

A. H. Upton, president of the company, completed the negotiations on a recent trip to Japan. C. T. Takahashi Co., Ltd., of Seattle, Wash., made the preliminary arrangements for International, maintaining liaison with Kinoshita & Co., Ltd., Tokyo, the Japanese steel mills' representative.

International Iron Mines, Ltd., and its subsidiary, Zeballos Iron Mines, Ltd., took over the mine property in 1959 from Anyox Metals, Ltd. About 9000 ft of diamond drilling is planned for 1961 at Zeballos.

Bethlehem Copper Corporation, Ltd.'s plans for development of its Highland Valley property are nearly completed. The management of Japan's Sumimoto Metal Mining Co., which holds an option on Highland Valley production, is withholding its decision to provide $7 to 9-million financing until it can appraise the final drafts of the plans this month. During the early production stages, Bethlehem will mine ore from the surface, and switch to underground operations later on. The plans provide for construction of a mill, for which the site is now being chosen.

In 1960, Cassiar Asbestos, Ltd., bettered its 1959 asbestos output by better than 10%, and recorded a simultaneous dollar sales volume increase of 10%. The company has found it more economical to extend its previous March to October mining season than to increase the rate of mining. The mill now runs all year and produces 1500 tpd.

Cowichan Copper Co., Ltd., is searching for a new orebody from among its properties at Nadira, Avallin, Caycuse, and Cellardon, using an exploration fund of about $100,000. A three-year contract with Japanese purchasers expires the middle of this month. During the term of the contract, the company shipped nearly 14-million lb of copper and 70,000 oz of silver to Japan.

Salmita Consolidated Mines, Ltd., and Mack Lake Mining Corp., of Yellowknife, have started work sinking a no. 2 shaft at Salmita's gold property at Matthews Lake, Northwest Territories. In preparation for collaring the no. 2 shaft, hard rock has been blasted at the shaft site to provide a foundation for the 75 ft headframe and hoist. The shaft will sink 400 ft and have three stations at different levels. Salmita also plans to build a new access road and to install a hydro power line to the site for further development work.

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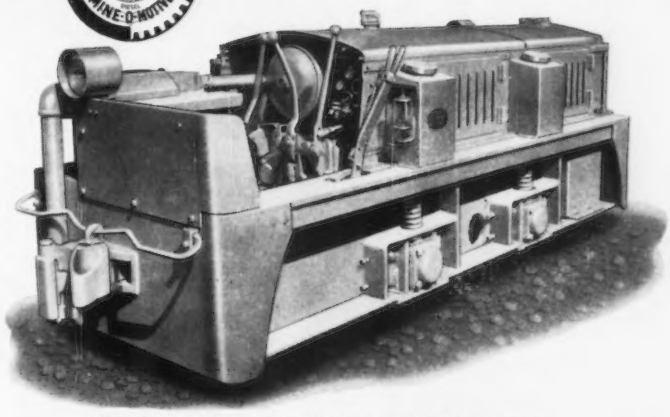
Mine Locomotives 3 to 12 Tons

Engineered expressly for

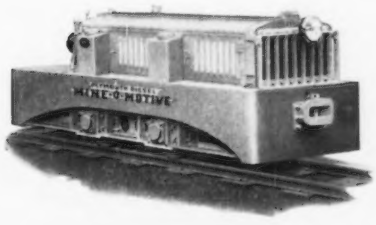
YOUR LOCOMOTIVE HAULAGE

in Today's modern mining operations

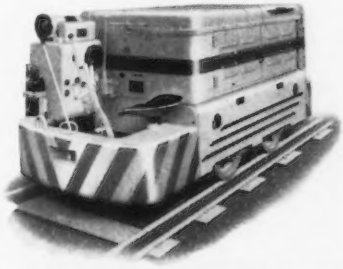
You will find these rugged locomotives performing the toughest hauling jobs in mines and tunnels everywhere. Stamina, stability—ECONOMY in performance, SAFETY in operation—and extra years of trouble-free operation—are ENGINEERED in the design and construction of the Mine-O-Motive series. Controls are convenient, simple, safe. Visibility is excellent. And the Diesel-powered models shown have the famous Torqomotive* Drive for easy starting and smooth operation. They supplement Plymouth gasoline, Diesel and Diesel-electric models which have served all industry since 1914—and with lowest ton-mile costs in the field.



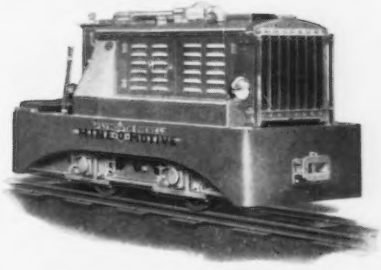
U. S. Bureau of Mines approved exhaust conditioning equipment.



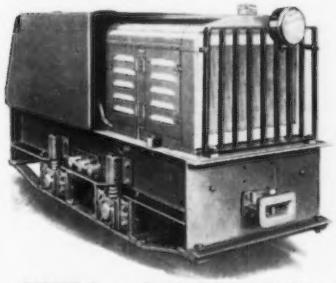
MINE-O-MOTIVE SERIES
Model FMD-00 5 or 6 Tons, Torqomotive* Drive—short wheel base, low center of gravity.



MINE-O-MOTIVE SERIES Model FMD-22 5, 6, 7, 8 or 10 Tons, Torqomotive* Drive (this model approved under Permissible Schedule #22, U. S. Bureau of Mines, for operation in gaseous mines).



MINE-O-MOTIVE SERIES
Model DMD-00, 8 to 12 Tons, with Torqomotive* Drive — low, compact, one-piece welded frame.



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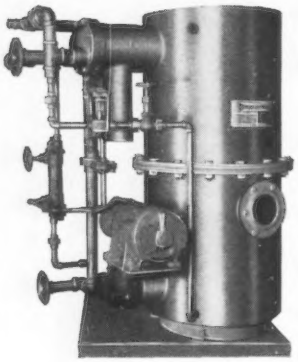

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B.C. (*Continued*)

Velvet Leasers, who are operating the Velvet mine of Mid-West Copper and Uranium Mines, Ltd. on a 15% royalty basis, have discovered an 8 ft wide gold-copper vein assaying 0.48 oz gold per ton and 6.5% copper.

Major Mines, Ltd., has started stripping work on the "Murphy Silver Mine," near Hope, in one of B.C.'s oldest mineral properties, Crown Grant no. 4. Silver was first discovered on the site in 1858, and samples shipped for assay around the Horn to Swansea Smelter, in Wales, were found to contain high values.

Anthony M. Arnold, an Alberta industrialist, has signed an agreement with Toluma Mining and Development Co., Ltd., to develop the mining facilities at Guichon Mine, Ltd.'s Copperada property. The agreement is contingent upon Arnold's providing $100,000 backing by Dec. 1961 if the results of current stripping examination should hold promise for profitable development. Early indications are that the property has a silica content of about 80% and gold-silver values of an undetermined amount.

Giant Mascot Mines, Ltd., has sold its 46-claim Spillimacheen barite property, including mill and all buildings, to Baroid of Canada, Ltd. The sale was made for $155,000.

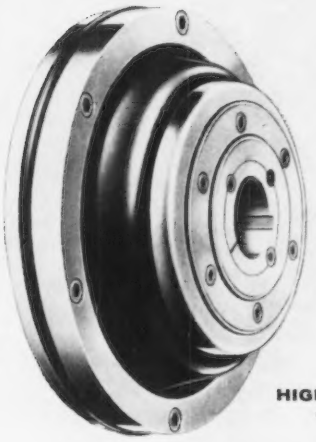
The Mining Association of B.C. has called for a royal commission investigation of B.C.'s silicosis-compensation pension structure. An anticipated Workmen's Compensation Board increase over the current 7% payroll assessment rate prompted Association protest. The increase is said to be under consideration as a remedy to a $900,000 deficit in the Workmen's Compensation Board's silicosis fund.

Mines Minister Kiernan gave qualified endorsement to the Association's proposal, saying that "A royal commission investigation might provide some information on the situation . . . but the problem is much wider than that."

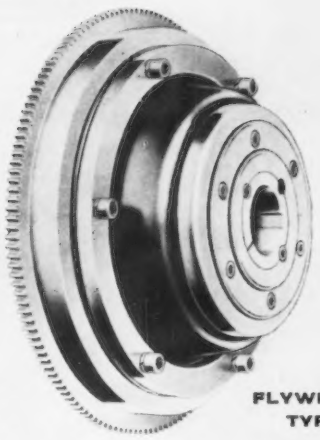
QUEBEC

Iron Ore Company of Canada wound up its iron shipment season this year well before normal closing. The lag in American demand saw shipments from Sept-Iles sag from 13,131,250 tons in 1959 to 8,809,276 tons in 1960. Overseas demand held fairly steady but accounted for only 3.0-million tons of the total.

Lamaque Gold Mines has started shaft sinking to develop the gold discovery at its gold producing property in the Bourlamaque district. The production-size shaft, at what is designated the No. 3 mine, will be put down to depth of 480-ft initially with three levels at 150, 300, and 450-ft horizons. Completion is scheduled for Apr 1, 1961. Lateral work is planned on all three levels to open the drill indicated orebody in the main vein. This was estimated to contain a minimum of 50,000 tons averag-



HIGH SPEED TYPE



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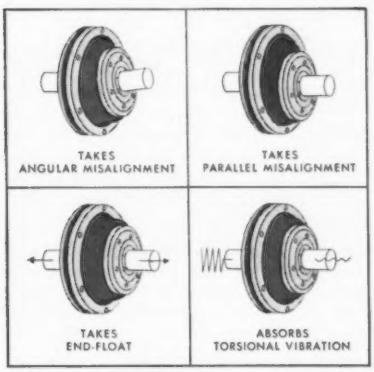
THE 4-WAY FLEX OF PARA-FLEX



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The new Dodge High Speed Para-flex is specially designed for operation with motors and internal combustion engines that turn up to 5230 rpm.

The new Flywheel Para-flex, with the same capabilities, has a flexing element that bolts directly to the flywheel of internal combustion engines.

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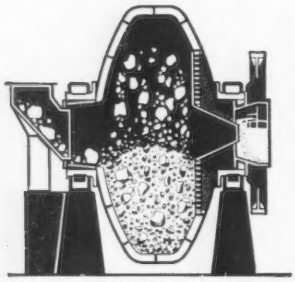
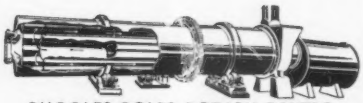
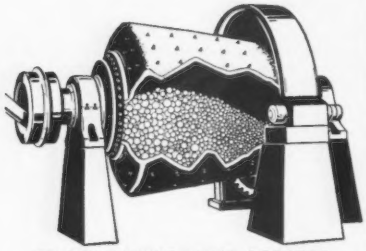


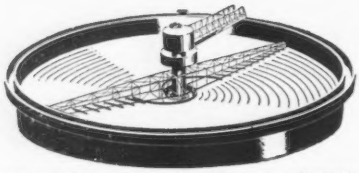
CASCADE® MILLS FOR AUTOGENOUS GRINDING



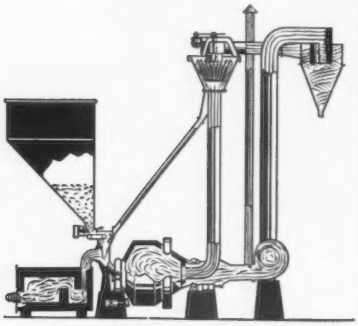
RUGGLES-COLES ROTARY DRYERS, KILNS AND HEATERS



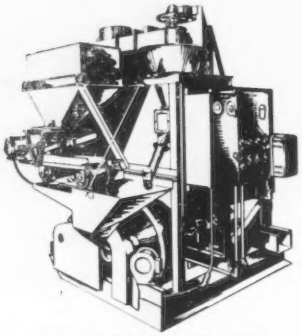
TRICONE MILLS WITH CORRECT BALL SEGREGATION



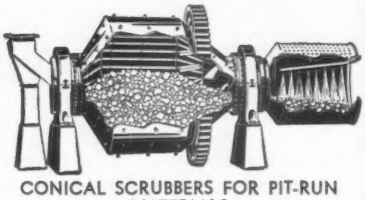
"AUTO-RAISE" THICKENERS—CLARIFIERS



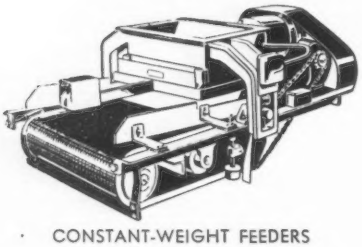
AIR CLASSIFYING SYSTEMS WITH "GYROTOR" CLASSIFIER



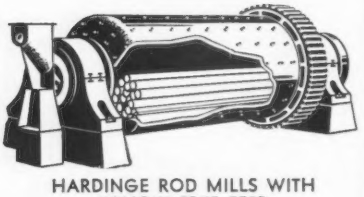
WET AND DRY-GRINDING PILOT-PLANT UNITS



CONICAL SCRUBBERS FOR PIT-RUN MATERIALS



CONSTANT-WEIGHT FEEDERS



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QUEBEC *(Continued)*

ing 0.33-oz gold per ton for a vein length of 250-ft to depth of 400-ft. Several other subsidiary structures were located in addition to two other gold-bearing veins to the north and southeast at distances of from 2500-3000 ft from the main showing.

Shaft sinking is getting under way at the Preissac Township molybdenite-bismuth property of Preissac Molybdenite Mines. The opening is to go to an initial depth of around 600-ft. Electric power has been brought in and construction of surface plant and buildings is progressing. Indicated reserves are estimated at 1,250,000 tons grading about 0.53% molybdenite. The company is controlled by Molybdenite Corporation of Canada.

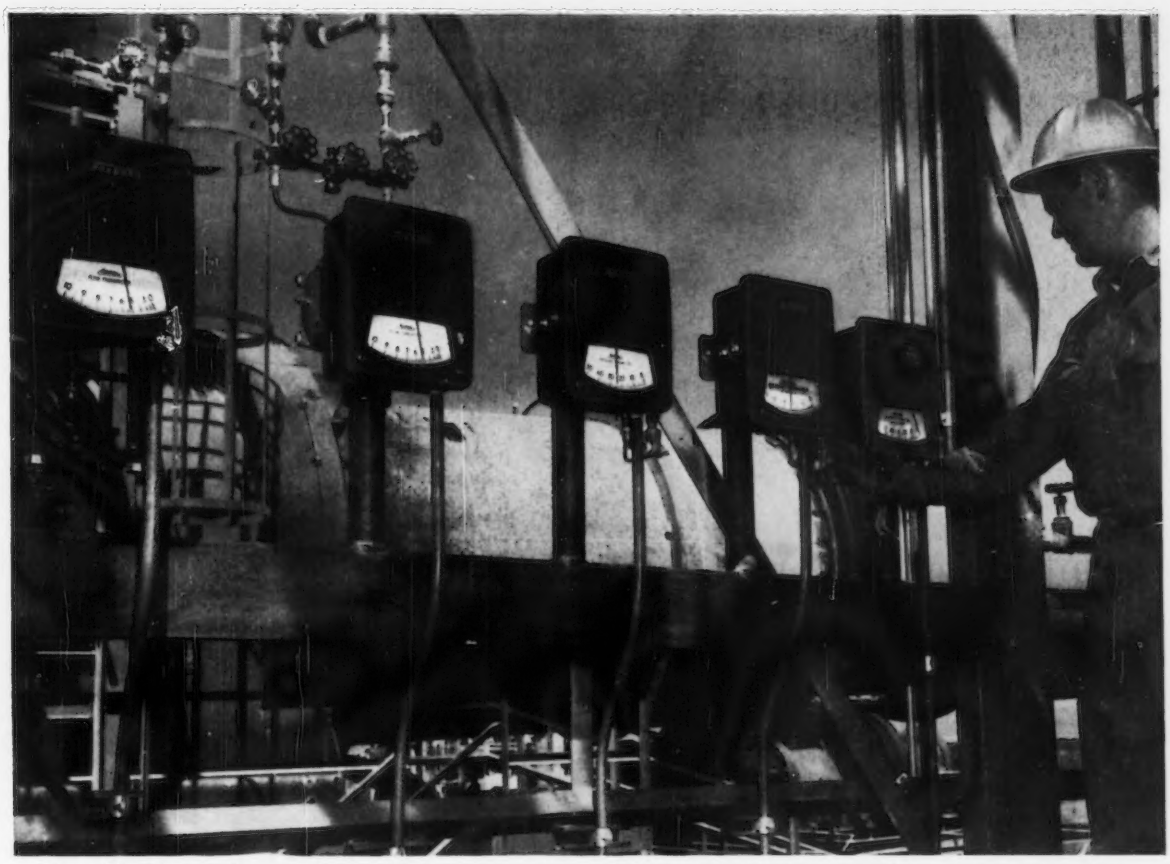
New Calumet Mines has indicated about 143,000 tons in the new orebody extending to depth at its base metal producing mine on Calumet Island, some 62 miles north of Ottawa. Grade is calculated at 12.3% zinc, 3.72% lead, 0.026-oz gold and 8.03-oz silver per ton before dilution. The orebody from the 1200-1925-ft levels is not yet delineated, and diamond drilling has been started to locate the new orebody on the 2050-ft level.

St. Lawrence Columbium and Metals Corporation has made a sales contract for a minimum of 500,000 lb of columbium pentoxide during a 15 month period beginning Oct 1, 1961, from its Oka properties near Montreal. Construction of a 500-tpd concentrator is currently underway. The sales agreement calls for increase to 1,000,000 lb the following year. Financing was obtained from an advance payment by Anaconda Company (Canada) of $1,600,000 in settlement of a balance of $2,327,500 for purchase of the Nakina iron properties in Northern Ontario.

Bevcon Mines, Val d'Or area gold producer, has located a new high grade gold vein on the 1900-ft level. Initially the vein has been drifted for a length of 225-ft with cut grade averaging 0.33 oz gold per ton over the drift width. An additional favorable development has been the increase in grade of mill feed from the neighboring Akasaba Gold Mines which is shipping about 250-tpd to the Bevcon mill.

Barnat Mines, Malartic area gold producer, more than doubled the tonnage it treated in the first nine months of 1960 compared with the corresponding period of 1959. Average mill rate for the period was 1170-tpd against 568-tpd in the first nine months of 1959. In the third quarter, the average had moved up to 1307-tpd.

Ghislau Mining Corp. expects to start retreatment of mill tailings this month at the former lead-zinc producing property of Anacon Lead Mines in Portneuf County, Eastern Quebec. The mill on the property has been modernized and re-equipped. Some 960,000 tons of tailings from former operations and 250,000 tons of ore will be treated in the 1000-tpd-capacity plant.



Type 630 indicating electronic Consotrol transmitter — shown here operating in a leading cement plant — may be equipped with any standard Foxboro measuring element. Transmitter continues to measure and indicate even in event of power failure.

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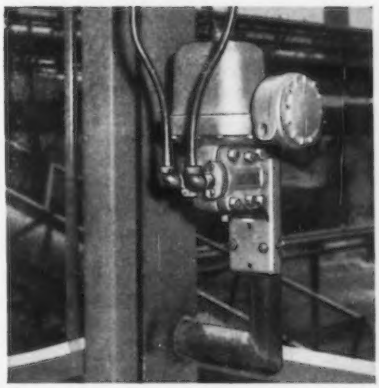

Type 613 d/p Cell* transmitter combines simplicity and accuracy of force-balance with speed and convenience of electrical transmission. Requires no power supply at the transmitter.

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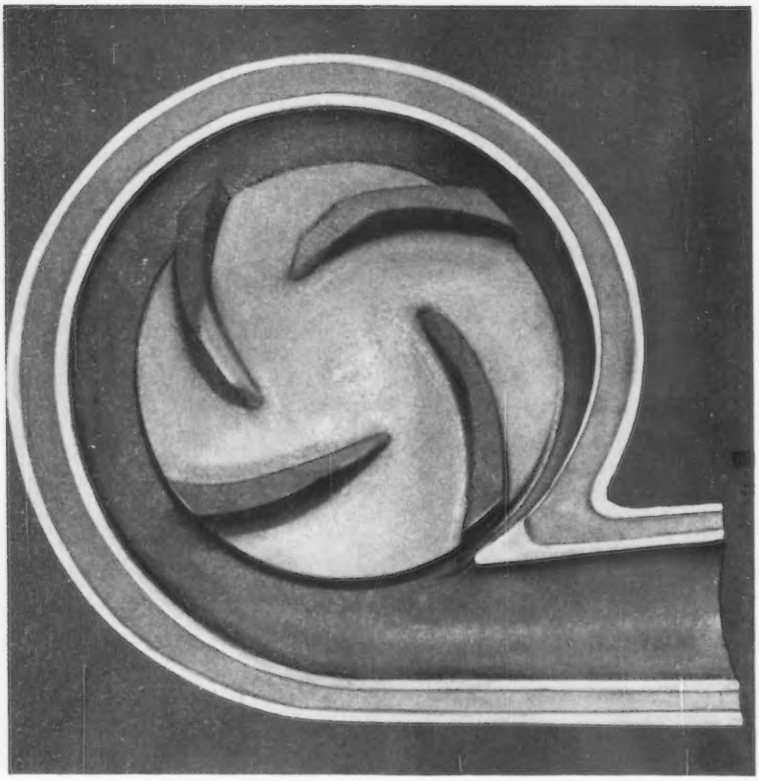

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The Almanite impellor shown was tested at Mt. Morgan Mining Company, Queensland, Australia in a Warman Cyclone Feed Pump used for the pumping of gravel sludges. Test results listed below demonstrate the superior service life of Almanite W over other materials in which this impellor was previously cast.

White Iron	*7 to 8 days*
Alloyed White Iron	*10 days*
Martensitic White Iron	*9 to 11 days*
28% Chrome Steel	*14 days*
Special Nickel Steel	*16 days*
ALMANITE W	*21 days*

Almanite W can readily be cast in all forms and shapes and is available through Meehanite foundries only. For more information, write to Meehanite Metal Corporation, 714 North Avenue, New Rochelle, New York.

MEEHANITE METAL

MEEHANITE CASTINGS ARE MADE ONLY BY MEEHANITE FOUNDRIES.

ONTARIO

Nickel Mining and Smelting Corporation, Ltd., is making steady progress in deep exploration of its nickel mine at Gordon Lake, some 55 miles northwest of Kenora. Drilling from drives on the three new levels at 1350, 1500 and 1650 ft. to test the "A" zone has been fairly well completed.

Kam-Kotia Porcupine Mines has set Apr. 1 as target for the start of production at its open pit copper operation 14 miles west of Timmins. Good progress is being made on mill construction and pit preparation. The mill will have a minimum capacity of 1000 tpd.

Lindsay Explorations, Ltd., has come up with a new copper-gold discovery, about 1.5 miles southeast of the main gold vein which it is preparing for production at its Sapawe area property. The new vein has been traced by a series of trenches for a length of 105-ft and possibility of extension is indicated in discovery of a small outcrop 450-ft to the west on strike and in the main zone still open to the east.

Teck-Hughes Gold Mines has purchased the former gold producing property of Kirkland Minerals adjoining the Teck mine in the Kirkland Lake area. The company plans to carry out exploration on the upper levels of the Kirkland property and to mine known ore in boundary pillars and other areas.

Temagami Mining Co. has stepped up exploration and development at its copper mine near Temagami. Drilling of the new No. 10 orebody which was located earlier this year has indicated a minimum of 2500 tons grading 13.5% copper. The orebody is still open on strike to the east. Work on the no. 6 high grade orebody, which is still open to the west, has indicated double the original reserve estimate of 21,000 tons grading 13% copper. Deep drilling is also in progress both east and west of the shaft below the 825-ft, or bottom, level.

Steep Rock Iron Mines, Ltd., has experienced one of the worst seasons in its 15 years of production. Shipments slumped from 2,746,849 tons in 1959 to 1,586,253 tons in 1960. The drop in ore demand was due to fall-off in American steel production. An anticipated fall pick-up failed to materialize last year.

International Nickel Company of Canada is embarking on a major expansion program designed to triple its iron plant at Copper Cliff. The program is expected to be completed in 1963 and will involve expenditure of some $50-million. The expanded treatment rate will be 1,200,000 tons of nickeliferous pyrrhotite per year. Net sales of the company (all products) in the first nine months of 1960 amounted to $383,536,000 against $317,580,000 in the corresponding period of 1959. Sales in the second and third quarters were less than in the first quarter, as had been anticipated.

McKenzie Red Lake Gold Mines is ob-

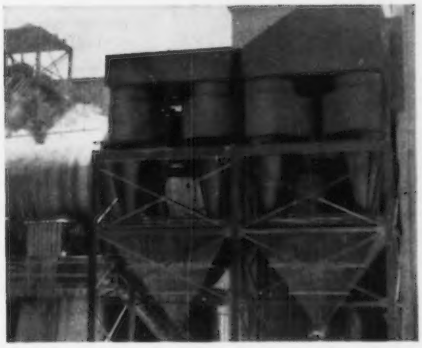
CYCLONE COLLECTORS

PRECIPITATORS

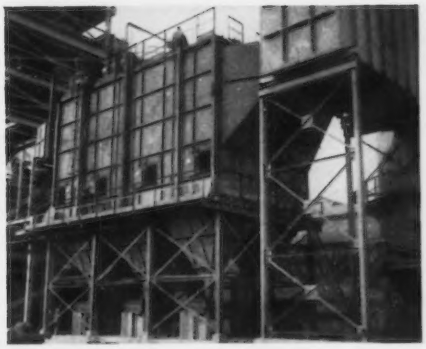
COMBINATION SYSTEMS

CLASSIFYING SYSTEMS

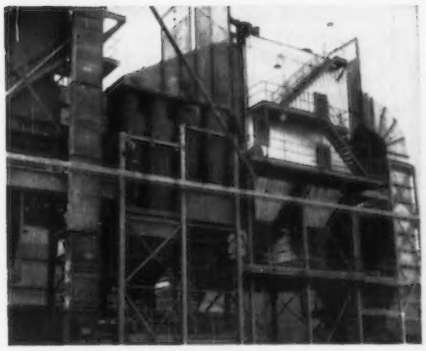
Where extra efficiency counts... Industry specifies BUELL



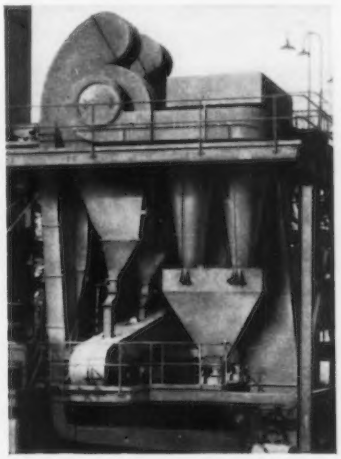
Buell Cyclone Collectors have the exclusive "Shave-off" design which utilizes double-eddy currents within the cyclones to trap an extra percentage of dust and minimize re-entrainment. Large-diameter design prevents bridging, clogging, or plugging. Extra heavy gauge construction contributes to long life. Buell-designed manifolding adds to efficiency of operation. Thoroughly described and illustrated in a booklet, "The Exclusive Buell Cyclone".



Buell 'SF' Electric Precipitators provide extra efficient recovery of dusts and lower maintenance costs year after year. The exclusive *Spiral-ectrodes* deliver 50 to 100% more electron emission than other types of emitting electrodes. Their self-tensioning characteristic minimizes electrode breakage. Buell Continuous Cycle Rapping practically eliminates "puffing". Positive Gas Flow Control through adjustable baffles assures maximum efficiency. Write for a copy of the extensively-illustrated booklet, "Buell SF Electric Precipitators".



Buell Combination Systems combine precipitators and cyclone collectors for the ultimate in profitable dust recovery. Buell Precipitators are unequalled in recovering fine dust particles, complementing the extra efficiency of Buell Cyclones. All three systems—cyclones, precipitators, and combination systems—are described in detail and thoroughly illustrated in a booklet, "The Collection and Recovery of Industrial Dusts".



Buell Classifying Systems are unique in operation, combining high efficiency with low power consumption and moderate capital investment. Patented features permit the separation of dry fine powdered or fibrous material from coarse material within a usual fine product range from 10 to 400 mesh. Systems are built in many sizes to handle from 100 pounds to 100 tons of feed product per hour without restriction on particle size or temperature. There are no moving parts. Power requirements vary from 0.04 to 0.5 fan hp per ton of feed per hour. A complete technical discussion is in a folder, "New Buell High Efficiency Classifying Systems".

buell Norblo

For full information on the application of Buell equipment to your plant's dust problems, write Dept. 19A, Buell Engineering Company, Inc., 123 William St., N. Y. 38, N. Y. Northern Blower Division, 6410 Barberton Ave., Cleveland, Ohio.

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ONTARIO *(Continued)*

taining promising results from its deep development work at its Red Lake gold-producing mine. Better-than-average grade ore is being encountered on the two deepest levels. On the 1450-ft level in the south end of the workings, a total length of 180-ft has been developed, with average grade of 0.32-oz gold over 3.1-ft. There is still some 800-ft of strike length ahead of the drive.

Willroy Mines has been obtaining excellent results in opening the main, or No. 3, zone on the new 9th level at its Manitouwadge area lead-zinc-copper-silver property. The first 100-ft of drifting and drilling returned an average of 1.38% copper, 10.13% zinc, 0.10% lead and 1.64-oz silver across a true width of 65 ft. Further west 25 ft, a composite assay of drift face and flat holes showed width of 35-ft averaging 1.50% copper, 11.25% zinc and 1.5-oz silver.

Production of uranium from the Elliot Lake area mine of Denison Mines for the third quarter of the current year is valued at $10.9-million, compared with $15.2-million for the previous quarter and $12.7-million for the first quarter. Reduction reflects cutback due to an extension of the delivery period.

Rio Algom Mines reduced its outstanding indebtedness to $24.6-million by the end of 1960. At the end of June, 1960, debts amounted to over $78-million. The rapid reduction is attributed to increased efficiencies at the uranium mines operated by the company in the Elliot Lake area. There are now four 3000-ton capacity plants, the Quirke, Nordic, Panel and Milliken, in operation. The Quirke is to be closed at the end of 1960 and the Panel by mid-1961.

North Coldstream Mines has produced 8,435,701 lb copper from milling 186,834 tons since production was resumed February 1960. Additionally, some $65,000 in silver was recovered. Average daily tonnage for the period which ended Sept. 30, 1960, was 873 tons. This rate reflected reduced tonnages in September due to a mechanical failure in the mill, which has a total capacity of around 1000-tpd.

A stepped up production schedule has been drawn up for Consolidated Mosher Mines in the Little Long Lac area. The gold property, adjoining that of the parent, MacLeod-Cockshutt Gold Mines, is to be brought in at an initial rate of 500-tpd by next March, with a full 2,000-tpd rate expected to be reached by the end of 1961. MacLeod will mine and mill the Mosher ore at cost plus 10¢ per ton.

What has been described as a high-grade gold-silver discovery has touched off a staking bee in the Fort Hope area, some 100 miles north of Nakina. The find is reported to have been made by prospectors employed by the Little Long Lac organization but details are not yet available. Several companies, including Independent Mining Corp., Consolidated Mining and Smelting, and Zulapa Mining Corp., are known to be in the area, and several hundred claims are staked.

Macassa Mines has resumed depth-development at its gold-producing mine in the Kirkland Lake area. The No. 2 winze is being taken down an additional 600-ft below the 5600-ft level; this will permit the opening of four new levels. Early in 1960, the No. 2 service shaft was deepened from the 4000 to the 4625-ft horizon as the first phase in the new depth program. Production this year is running ahead of 1959, reflecting the higher grade of the ore being treated. Average recovery in the first 10 months, 1960, was $16.31 per ton, against $14.58 in the like period of 1959.

NEW BRUNSWICK

Mount Pleasant Mines and Kennco Explorations (Canada) have resumed drilling on the former's molybdenite-tungsten-tin-zinc prospect in Charlotte County. In previous drilling, promising values were obtained in 16 holes. Average width of the zones probed is about 14.6 ft. Of these, 15 zones have indicated widths of better than 20 ft. Research is being conducted as a preliminary step to full-scale mill tests.

NEWFOUNDLAND

M. J. Boylen Prospectors is continuing an aggressive search for new mines after bringing one mine into production and two others to the mill-building stage. The first was the Tilt Cove copper mine of Maritimes Mining Corporation, Ltd. The second is the Little Bay copper mine of Atlantic Coast Copper Corpora-

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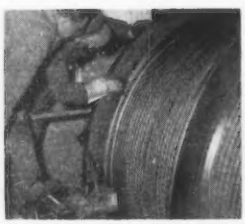
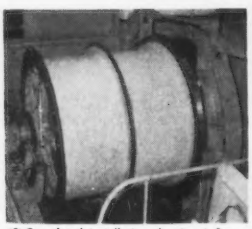


(1) This view shows one method of removing tapered wedges or end fillers on helical grooved cast iron drum.

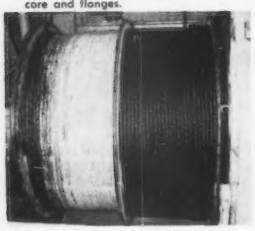
(2) Shows process of drilling a steel sleeve to be bolted to a cast iron drum.

(3) Shows installation of steel sleeves and steel ware plates on the flanges and welding the sleeves and plates firmly together giving a complete steel drum core and flanges.

(4) Shows installation of LeBus grooved segments to the steel drum core by the process of welding.



(5) Completed installation showing LeBus Counterbalance Spooling System installed on a 72" by 36" double drum for 1-¼" line.



(6) View shows overwind and underwind spooling operation where 3 and ½ layers of 1-¼" line are being spooled on to the drum.

Five more skips per hour have been made possible by installation of this LeBus Counterbalance Spooling.

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The Coeur D'Alenes Co., Wallace, Idaho

NEWFOUNDLAND *(Continued)*

tion, Ltd., where mill construction has started and the third is the Baie Verte asbestos property of Advocate Mines, Ltd., where mill construction is scheduled to start next spring.

Four new projects, two of which, the Rambler and the Terra Nova, were opened by shafts in operations by former owners, are now in progress. The Rambler is a base metals-gold-silver prospect and the Terra Nova is a copper prospect, both in the Burlington Peninsula. Underground work and diamond drilling is to be done on these mines. On the other two, drilling is now underway. These comprise the Baie Verte concession near Advocate and the Winisk Metals group adjoining Maritimes Mining at Tilt Cove.

NOVA SCOTIA

Magnet Cove Barium Corp. has discovered a rich lead-silver orebody underlying its big barite orebody at Walton. Some 450,000 tons have been indicated to the 850-ft horizon, with grade running around $32 per ton and more. A decision has been made to construct a 125-ton capacity concentrator. The new orebody can be mined through existing workings and with present plant. The discovery comes at a time when barite production is to be reduced due to slump in demand.

IN LATIN AMERICA

CHILE

A growing disparity between internal operating costs and foreign exchange rates has been cited by Harry F. Guggenheim, board-chairman of Anglo-Lautaro Nitrate Corp., as the reason for a profit drop in the fiscal year ended June 30, 1960. In spite of the fact that the company "made progress" last year in its modernization program, costs were increased by Chilean law-imposed wage and salary increases, for which no compensation has been available in foreign exchange rates. Two remaining projects in the company's renewal program will be completed this year: mechanical loading facilities at the Port of Tocopilla and new power-generating equipment at the Pedro de Valdivia plant. Mr. Guggenheim also said that he expects the financial results of the year 1960-1961 to be jeopardized by the increased costs of the labor contract, and higher prices for locally purchased materials.

The National Mining Enterprise, the name now given to the new government agency formed by the merger of the Mining Bank and the National Smelter Enterprise, has decided to go in for iron ore buying from the small miners at Huasco and Chañaral, two of the most

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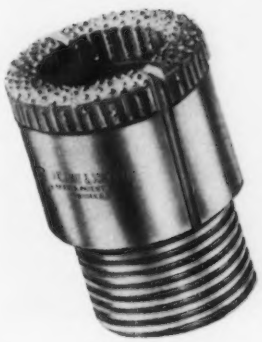

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SCOOT-CRETE CD-4, shown being loaded in mine, will carry up to 15 tons payload. Model CD-3N has 5-ton payload. Note driver's side-mounted position for maximum vision and efficiency, forward and rear.

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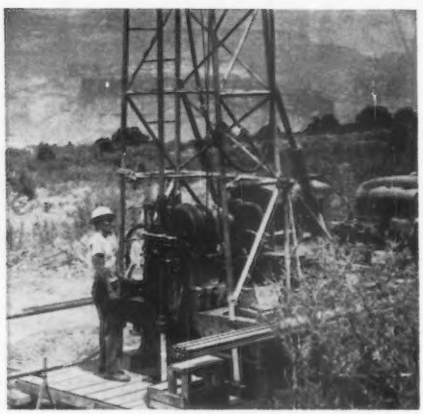

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CHILE *(Continued)*

important iron producing districts in the country. Until now iron ore buying had been in the hands of private companies.—Such is not the case with copper ores and concentrates, which are mostly bought by the Mining Enterprise for the Paipote smelter and its several flotation mills.

Taking advantage of the good summer weather, Cerro de Pasco Corporation is pushing ahead with development work at its Rio Blanco property east of the town of Los Andes and near the Rio Blanco depot on the Transandien railroad from Los Andes to Mendoza. At the present time some 600-m of tunnels are being driven to shorten the long haul to the mine over the Andes mountains. At the latitude of the Rio Blanco property, work at the surface is only possible during the summer months.

Cia. Minera Disputada, now controlled by Peñarroya, is activating the construction of its 3,000-tpd mill and its 400-tph aerial ropeway to haul the ore from mine to the new mill.

Compania Salitrera de Tarapaca and Antofagasta has invested $3.6-million and plans to spend another $4-million to build a new crushing plant and enlarge its Victoria plant, which uses the Cappelan-Smith-Guggenheim process.

Cerro de Pasco plans to invest about $82-million over the next five years to bring its annual production to 60,000 tons.

Cia. Minera Disputada will invest about $20-million in its El Soldado and Disputada mines and at the Chagres copper smelter in an attempt to increase its copper output from the present 14,000 tpy to 36,000 tpy by 1965.

Cia. Minera Mantos Blancos will start producing 12,000-tpy of copper in 1961, and hopes to increase its output to 18,000-tpy by 1962.

In the development of the Algarrobo iron mine in Vallenar, the steel mill at Huachipato will invest $24.5-million. This investment will cover the construction of a railroad link to the Huasco-Vallenar line and of an iron ore-loading wharf at the Huasco harbor. Algarrobo expects to be producing 1.2-million tpy by 1963.

Cia. Minera Santa Fe will start 700,000-tpy iron ore production in 1961 from its Carmen mine near El Salado. About $3-million has been spent on the Carmen mine, and the company plans to spend about $12-million on its other iron ore properties over the next three years.

A Chilean sub-company organized by Japan's Mitsubishi organization to mine iron ore from the Adrianitas mine northwest of Copiapo has invested $7-million in the mine, roads and a wharf at Calderrilla harbor. The company's name is Cia. Minera Atacama. Plans call for 600,000-tpy production in 1961, and 1.3-million tpy production by 1967.

CHILE *(Continued)*

The Chilean government is planning to spend $10-million in the Ventanas copper smelter, which should be finished by the end of 1962.

The three copper smelters of Paipote, Chagres and Ventanas expect to be producing 50,000 tpy of blister copper by 1963. The government will also spend $700,000 during the next two years in a geological prospecting plan in the northern provinces from Atacama to Tarapaca. The United Nations will contribute $1-million to this prospecting work.

VENEZUELA

Cerro San Isidro, a national reserve iron-ore deposit in the same area as Orinoco Mining Co.'s Cerro Bolivar, has in excess of 300-million tons with Fe content of 64%, according to a preliminary estimate of the Ministry of Mines and Hydrocarbons. The estimate is based on the results of drilling 79 test holes with total footage of 23,750-ft. The reserves of neighboring Punta de Cerro are estimated at 12-million tons with Fe content of 50%, based on drilling 20 test holes with total footage of 2200 ft. The Ministry is continuing with transverse profile tests and chemical analysis of drilling samples.

JAMAICA

Kaiser Bauxite Company has cut back production of Jamaican bauxite almost 50% and is laying off approximately 10% of its labor force. Until March 1961, Kaiser will ship only about 200,000-tpm, as compared with its usual 400,000-tpm. Donald Farquharson, vice-president of the company, has attributed the cutback to generally slow conditions in the American and world aluminum markets.

The two other bauxite companies in Jamaica, Alumina Jamaica and Reynolds Jamaica Mines, have indicated that they are not considering any retrenchment and that their production and mining will continue as usual. A fourth company, Alcoa, is now letting contracts to build port facilities and a railroad for future mining operations in 1963 or 1964.

IN AUSTRALIA

South Alligator Uranium N.L. earned a profit of £A228,127 for the 11-month period ended August 31, 1960. The oxide output, 6062 short tons, was about 6% above the production target, but the head grade of 0.92% was slightly below estimates. Exploratory work disclosed an additional ore zone extending 2000-ft from the mouth of the No. 2 adit to Sterritts outcrop. Further exploration is being done in other areas.

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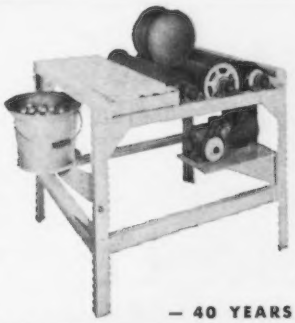

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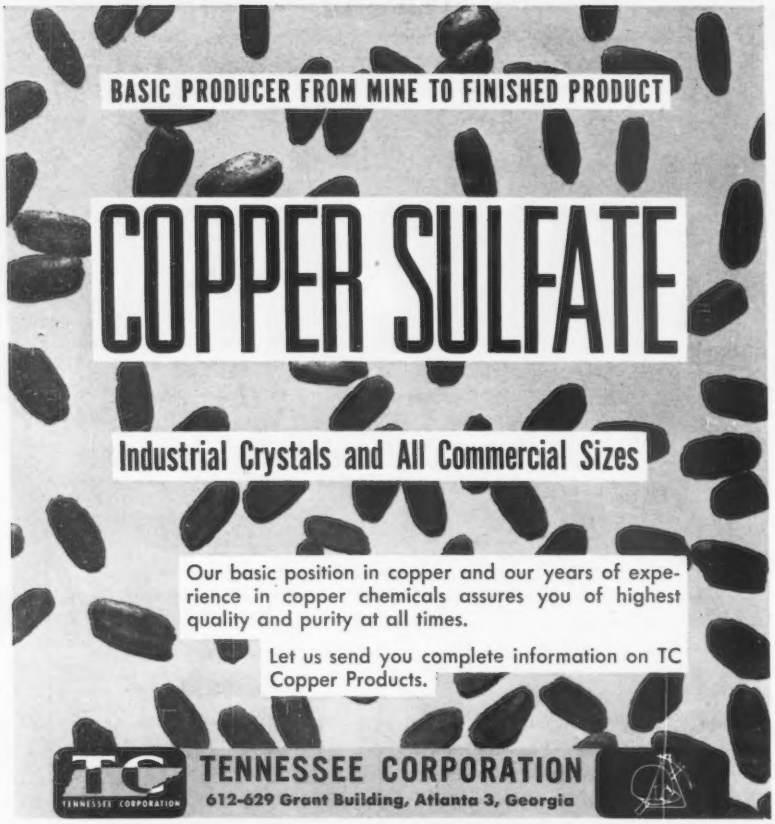
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AUSTRALIA *(Continued)*

Mining Corp. (Australia) N.L. has abandoned work at Mt. Isa and Mt. Novit because prospects did not warrant further investigation. Only weak copper mineralization was encountered, and the extension of the Mt. Isa orebody was not located.

Electrolytic Zinc Industries, Ltd., has started its Risdon extension project, which will increase zinc production to 140,000-tpy. Current output is about 118,000-tpy. The project will cost about $4.5-million. In addition, the company is installing a plant at Risdon which will recover zinc from zinc plant residues. About half a million tons of residues are available with up to 20% zinc content, plus some lead, silver and cadmium values.

Three trial shipments of bauxite from Weipa fields on the Cape York Peninsula will be shipped to Japan early in 1961. If Japanese tests are successful, the shipments will be followed by larger ones as port facilities at Weipa are enlarged.

A-1 Consolidated Gold N.L. incurred a loss of £A33,657 during the past fiscal year. Though the mill output rose from 6160 to 9060 tpy, the grade dropped from 12.6 dwt per ton. Development work on the No. 23 level indicated, however, that a payable orebody may be located in the mine's south end.

Despite a fall in working costs of about 12%, Ravensthorpe Copper Mines N.L. showed a loss of £A6725 in its past fiscal year. However, the company expects improved results this year.

PHILIPPINES

Atlas Consolidated increased its copper milling rate at its Toledo mill in October 1960 to 10,000 tpd. In the same period, copper recovery rose to over 3-million lb, an increase of 419,000 lb over September. The grade of ore milled increased to 0.63% copper. Atlas Consolidated's barter agreement with Japan for copper has been extended for one year through November 15 1961, for the equivalent of 12,586 tons of copper in concentrates.

Lepanto Consolidated, the Philippines' second largest copper producer, milled 41,000 tons of ore in October at a daily rate of 1360 tons. Production was estimated at just under 2.5-million lb of copper and 4130 oz of gold.

Gold producers have petitioned the Monetary Board for exemption from the 25% margin fee for the purchase of their import requirements. The board has decided to buy all newly-mined gold at 131.25 pesos per oz, or at the rate of 3.75 pesos per dollar. However, it does not appear likely to the producers that gold can be mined profitably at this price, since average production costs are 145 pesos per oz.

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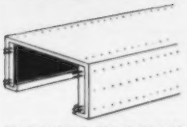

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BUCKET: Williams 1¼ yd. clam shell, material handling.

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42" x 30", double drum, 75 or 150 H.P.
72" x 50", double drum, 400 H.P.
72" x 64", double drum, 400 H.P.
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5—2¼" x 3½" New Morse Lab Crushers
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1—4'6" x 4' Hirsch Ball Mill
1—64½ Marcy Ball Mill
1—8' x 22' Hardinge Conical Pebble Mill
1—3' x 7' Morse New Rod Mill
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1—2" Dorr duplex
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1—2" American-Marsh 2 stage
1—2" Hill 4 stage
1—2" Union 6 stage
4—2½" Pennsylvania 4 stage
1—2½" Buffalo 4 stage
1—2½" Pacific 6 stage
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1—3" Hill 3 stage
1—3" Buffalo 4 stage
2—3" United 5 stage
2—3" Union 6 stage
3—3" United 6 stage
1—4" Ingersoll-Rand 2 stage, type 4GT2, 1000 GPM, 920' head with 300 HP motor
1—4" Platt 2 stage
1—5" Manistee 8 stage
1—6" Byron-Jackson 4 stage, 1000 GPM, 1600' head, with 500 HP motor

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2—5 HP Sturtevant new axivane mine fans with 115 volt D.C. motors
1—8H-42" Jeffrey "Aerodyne" mine fan
1—10' Joy-LaDel axial flow mine fan
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1—4" x 6" Victor-Acme rotary blower
1—7" x 17" Victor-Acme rotary blower
1—12" x 30" Sutorbilt rotary blower
1—16" x 48" Roots-Connersville rotary blower
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1—1½ HP Jeffrey "Aerodyne Midget" exhauster
1—American #70-E exhauster
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AIR SLUSHER HOISTS
1—HNNIJ Ingersoll-Rand Double Air Slusher
1—F-211 Sullivan Double Drum Air Slusher
1—F-212 Sullivan Double Drum Air Slusher

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1—1 Ton General Electric
1—3-4 Ton GE Type LSB-2C4
1—4 Ton Westinghouse—Baldwin
1—5 Ton Atlas Type A
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1—7 Ton Atlas
2—8 Ton General Electric, type LSB-2C8
1—8 Ton Goodman, type 42C04T
3—8 Ton Ironton, type WO
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4—10 Ton Atlas, type A

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2—Ingersoll-Rand Model 10HR
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1—Denver 5' x 10' rod mill

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2—8' x 56' Kilns, ½" welded
2—8' x 40' Stearns-Roger dryers
1—7'6" x 62' rotary kiln, ½"
2—7' x 60' Bonner dryers, ⅝" shell
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1—3'6" x 21' dryer, ⅜" welded
1—3' x 23' dryer, ¼" welded

MILLS—CRUSHERS
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1—Kennedy 7' x 9' ball mill 150 HP
1—Denver 5' x 10' rod mill, 100 HP
1—Hardinge 10' x 48' conical ball mill
2—Hardinge 7' x 36" conical pebble mills
3—Hardinge 6' x 48" conical ball, 75 HP
1—Hardinge 4'6" x 16" conical ball mill
1—Allis-Chalmers 5' x 5' ball mill, 75 HP
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5—#14 Deister Diagonal Deck, 1½ H.P. motor

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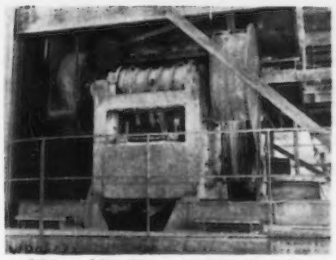

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10 #250 Denver unit cell
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1—20 NM2C Ing. Rand, 2 drum, 20 H.P. 440 V.
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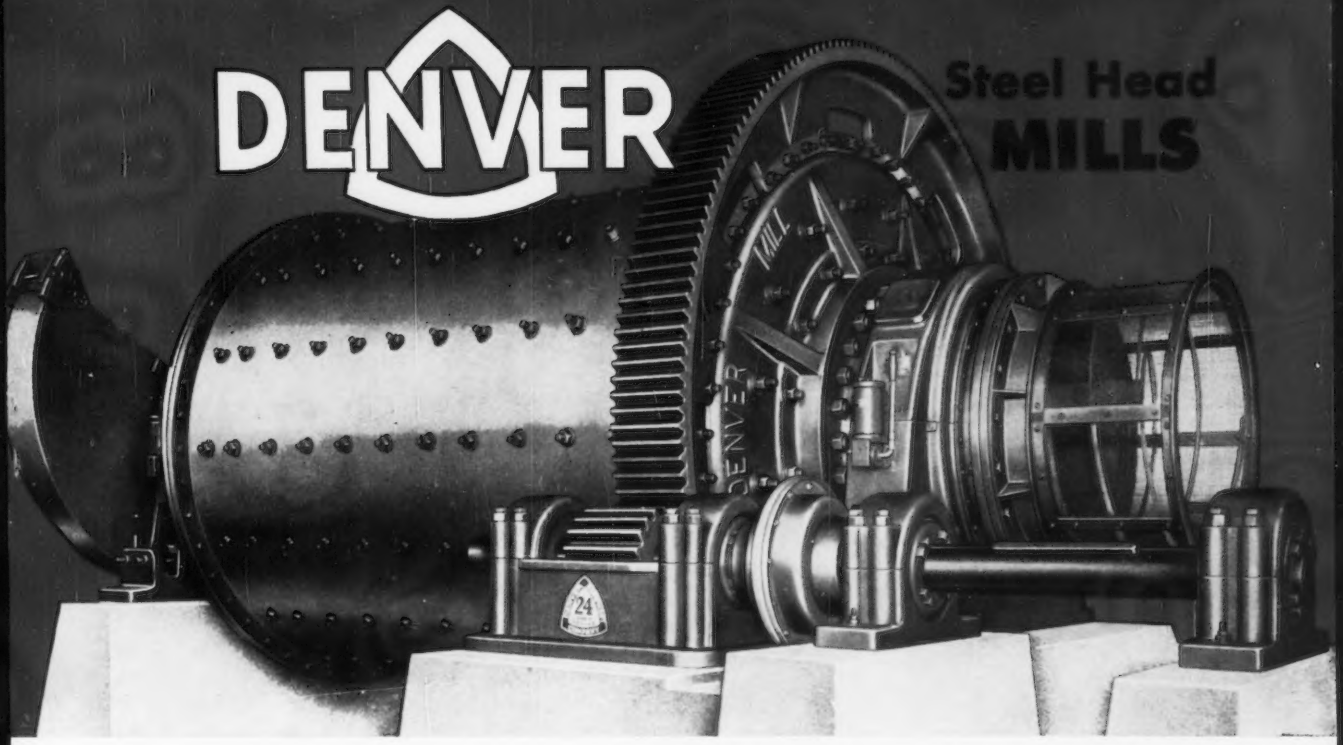

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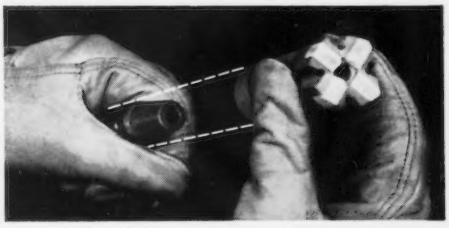

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